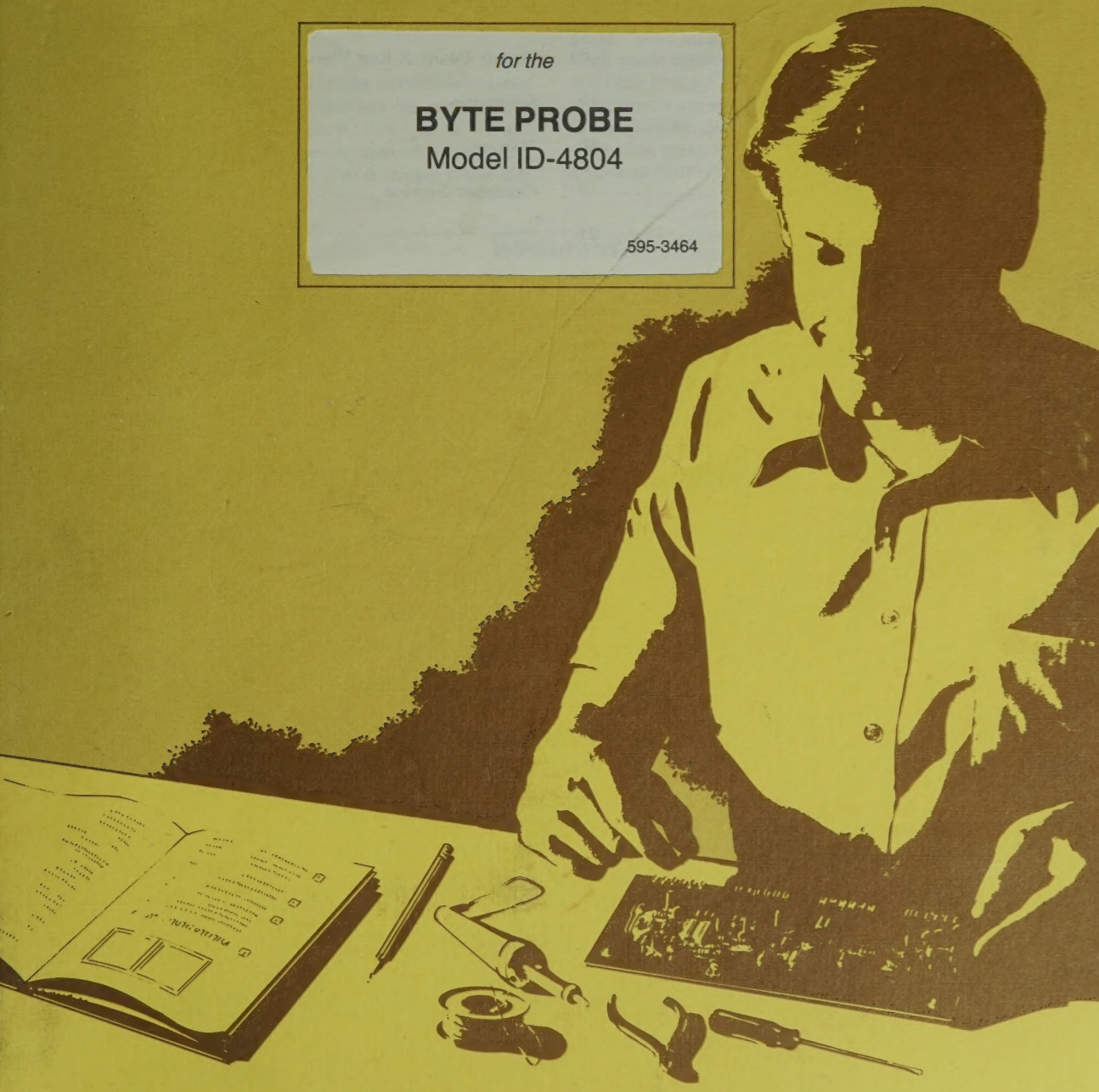
HEATHKIT® MANUAL

for the

BYTE PROBE
Model ID-4804

595-3464



HEATH COMPANY • BENTON HARBOR, MICHIGAN

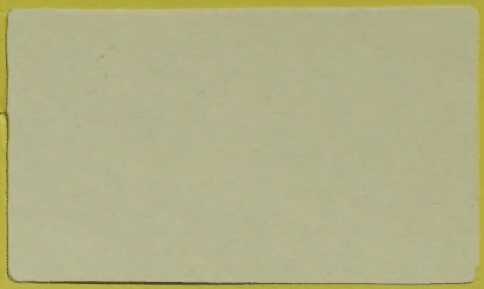
HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571

Technical Assistance Phone Numbers
8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

Audio	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and Home Clocks	(616) 982-3315
Television	(616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive, Appliances and General Products	(616) 982-3496
Computers — Hardware	(616) 982-3309
Computers — Software:	
Operating Systems, Languages, Utilities	(616) 982-3860
Application Programs	(616) 982-3884



YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heath/Zenith Computers and Electronics center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

BYTE PROBE
Model ID-4804

595-3464

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

INTRODUCTION

Your ID-4804 Byte Probe is a unique test instrument you can use to check the logic states of address lines, data lines, and any general TTL or CMOS circuitry that operates from a +5 VDC supply. It's compact size, rugged case design, and portability make it ideal for field use.

The Byte Probe contains eight switch-selectable input channels. Each channel can be switched to detect logic "1" (high), logic "0" (low), or "X" (don't care). A logic "1" state in each channel is indicated by a red LED. Trigger output and trigger input circuits allow you to series (loop-connect) more than one Byte Probe together for testing more than eight lines simultaneously, or to trigger an oscilloscope or other test instruments. A "time" switch allows you to select one of three display modes: real time, pulse "stretching" or latch (data acquisition). The latch mode retains the display until you manually reset the Probe. Coincidence occurrences (when all eight inputs are equal to the specific logic condition established by the input switches) are indicated by a separate green LED. Power is supplied by a 9-volt transistor battery or optional battery eliminator.

IMPORTANT

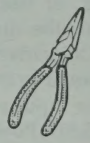
You will need one of the following power sources to operate your Byte Probe:

1. 9-volt "transistor" battery (NEDA type 1604).
2. 9-volt battery eliminator (Heath Model PS-2350).

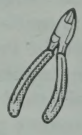
ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.

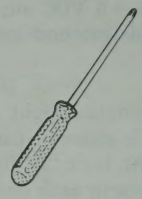


LONG-NOSE PLIERS



DIAGONAL CUTTERS

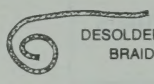
WIRE STRIPPERS



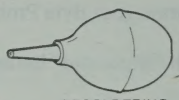
PHILLIPS SCREWDRIVER

OTHER HELPFUL TOOLS

NUT STARTER
(May Be Supplied With Kit)

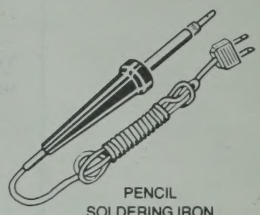


DESOLDERING BRAID*



DESOLDERING BULB*

*To Remove Solder From Circuit Connections.



PENCIL SOLDERING IRON
(22 to 25 WATTS)

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.

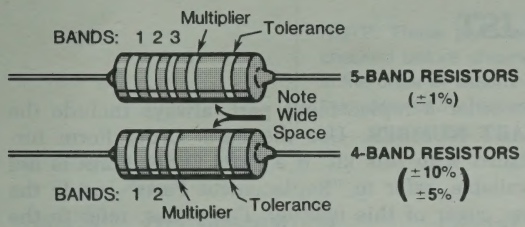
2. Refer to the separate "Illustration Booklet" for the Pictorials and Details. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in the proper sequence, as called for in the steps.

3. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

4. Position all parts as shown in the Pictorials.

5. Solder instructions are generally given only at the end of a series of similar steps. You may solder more often if you desire.

PARTS

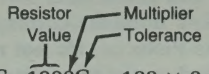


Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms). They are usually identified by a color code of four or five color bands, where each color represents a number. These colors will be given in the steps in their proper order (except for the last band, which indicates a resistor's "tolerance"; see the "Resistor Tolerance" chart, below). Therefore, the following color code is given for information only.

	Band 1	Band 2	Band 3 (if used)	Multiplier
Color	1st Digit	2nd Digit	3rd Digit	
Black	0	0	0	1
Brown	1	1	1	10
Red	2	2	2	100
Orange	3	3	3	1,000
Yellow	4	4	4	10,000
Green	5	5	5	100,000
Blue	6	6	6	1,000,000
Violet	7	7	7	0.01
Gray	8	8	8	0.1
White	9	9	9	

Occasionally, a "precision" or "power" resistor may have the value stamped on it. The letter R, K, or M may also be used at times to signify a decimal point, as in: 2R2 = 2.2 Ω
2K2 = 2.2 kΩ, or 2200 Ω
2M2 = 2.2 MΩ

Precision resistors may also be marked as shown in the following examples. The values of the multipliers are shown in the "Multiplier Chart," and the tolerance values are shown in the "Resistor Tolerance" chart.



EXAMPLES: 1009C = 100 × 0.1 = 10 Ω, ±0.25%
1001D = 100 × 10 = 1000 Ω, ±0.5%

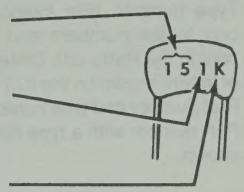
MULTIPLIER CHART			
FOR THE NUMBER:	MULTIPLY BY:	FOR THE NUMBER:	MULTIPLY BY:
0	1	4	10,000
1	10	5	100,000
2	100	8	0.01
3	1000	9	0.1

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar®, electrolytic, etc. Some capacitors may have their value printed in the following manner:

First and second digits of capacitor's value: 15

Multiplier: Multiply the first & second digits by the proper value from the "Multiplier Chart."

To find the tolerance of the capacitor, look up this letter in the capacitor Tolerance chart.



EXAMPLES: 151K = 15 × 10 = 150 pF
759 = 75 × 0.1 = 7.5 pF

NOTE: The letter "R" may be used at times to signify a decimal point, as in: 2R2 = 2.2 (pF or μF).

RESISTOR TOLERANCE		
	COLOR OR LETTER	
±10%	SILVER	
± 5%	GOLD	J
± 2%	RED	G
± 1%	BROWN	F
±0.5%	GREEN	D
±0.25%	BLUE	C
±0.1%	VIOLET	B
±0.05%	GRAY	

CAPACITOR TOLERANCE		
LETTER	10 pF OR LESS	OVER 10 pF
B	±0.1 pF	
C	±0.25 pF	
D	±0.5 pF	
F	±1.0 pF	±1%
G	±2.0 pF	±2%
H		±3%
J		±5%
K		±10%
M		±20%

PARTS LIST

Open the parts pack and check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial. **Do not remove any parts that are supplied on the tape strips until they are called for in an assembly step.** If a part is packed in an individual envelope, with a part number on it, identify the part; then place it back into the envelope until a step calls for it. Do not throw away any packing materials until you have accounted for all the parts.

To order a replacement part, always include the **PART NUMBER**. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this manual. For prices, refer to the separate "Heath Parts Price List.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

INTEGRATED CIRCUITS (ICs) – LED's

NOTE: Integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number. (For integrated circuits, this refers only to the numbers and letters shown in BOLD print in the Parts List. Disregard any other numbers or letters shown on the IC.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

CAUTION: Some of the integrated circuits can be easily damaged by static electricity. DO NOT remove any ICs from their foam pads until you are instructed to do so in a step.

A1	442-627	1	**78L05**	U105
A2	443-792	1	**74LS132**	U104
A2	443-1231	1	**74ALS30**	U103
A2	443-1288	2	**74HC75**	U101, U102
A3	412-642	1	Green LED	V109
A3	412-654	8	Red LED	V101, V102, V103, V104, V105, V106, V107, V108

SOCKETS – CONNECTORS

B1	432-798	1	Battery connector	
B2	432-866	7	Spring connector (1 extra)	
B3	432-1030	3	2-pin connector shell	
B4	432-1044	1	7-pin plug	P101
B5	434-298	2	14-pin IC socket	
B5	434-299	2	16-pin IC socket	
B6	436-28	1	Battery eliminator jack	J1

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

WIRE – CABLE

C1	134-237	1	Cable assembly
	340-8	12"	Bare wire
	347-66	12"	25-wire flat cable

MISCELLANEOUS

D1	60-659	9	3-position slide switch	SW101, SW102, SW103, SW104, SW105, SW106, SW107, SW108, SW109
D2	60-660	1	2-position slide switch	SW112
D3	64-946	1	Pushbutton switch	SW11
	73-64	2	Foam gasket (2" each)	
	85-3083-1	1	Circuit board	
D4	203-2285	1	Front panel	
D5	203-1228	1	Slide panel	
D6	250-1409	4	4-40 × 3/8" self-tapping screw	
D7	250-1412	4	4-40 × 1/2" phillips screw	
D8	260-715	1	Pack of 9 micro clips*	
	305-122	1	Cabinet consisting of:	
D9	*95-668*	*1*	*Cabinet top*	
D10	*95-669*	*1*	*Cabinet bottom*	
D11	*485-56*	*1*	*Cainet side*	
D12	462-1196	1	Gray button	
D13	490-111	1	IC puller	
	490-185	1	Solder wick	
D14			Blue and white label**	
		1	Assembly Manual (See Page 1 for Part Number.)	
	597-260	1	Parts Order Form**	
		1	Solder	

* Mark the individual clip part number, as indicated on the pack, in this space: 260 – ____. If you need to order individual replacement clips, use this number.

** These items may be packed inside the Manual. Set them aside for use later.

TAPED COMPONENTS

NOTE: These parts are taped on a strip which was checked before shipment. Since the parts are taped in the order of assembly, it is not necessary to check them against the following list.

RESISTORS

All 5% resistors have four color bands (last band gold for). The last band (gold) will not be called out.

All resistors are rated at 1/4-watt unless specified otherwise.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-182-12	1	1800 Ω (brn-gray-red)	R112
6-472-12	10	4700 Ω (yel-viol-red)	R109, R113, R114, R115, R116, R117, R118, R119, R121, R122
6-511-12	9	510 Ω (grn-brn-brn)	R101, R102 R103, R104, R105, R106, R107, R108, R111

CAPACITORS

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
21-786	1	.1 μF (104) axial-lead ceramic	C101
25-197	1	1 μF axial-lead tantalum	C102

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 1-1 for the following steps.

NOTES:

1. Many circuit board drawings, such as the one shown in Pictorial 1-1, are divided into two or more sections. These sections show you which area of the circuit board you are working in for a specific series of steps.

2. Cut the "Taped Component Chart" from the last page of the Illustration Booklet. Make sure you read the instructions at the top of the chart before you use it. Note that it is divided into numbered sections which correspond to the numbered sections on the circuit board pictorial. The components are listed in the order of assembly.

3. In each series of steps, corresponding to a circuit board section, you will install parts in a top-to-bottom, left-to-right sequence. Occasionally, you may be directed to install a particular component in an area out of sequence. Each of these components is identified in the step and on the Pictorial with a special callout (R102, C104, or D101, for example).

4. As you perform each step, check it off in the box provided. You may also wish to place a check mark near each component on the Pictorial as you install the part.

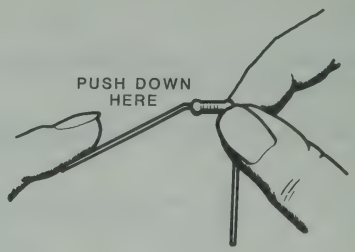
5. In general, solder instructions are given only at the end of a series of similar steps; you may solder more often if you wish.

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on the circuit board.

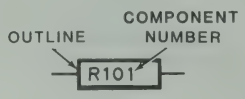
Note that one side of the circuit board has the component outlines shown on it. This is referred to as the "component side." Position the circuit board as shown in the Pictorial with the component side up. Always install components on the component side of the circuit board, and solder the leads to the foil on the other side.

Section 1

( ) Hold a 510 Ω (grn-brn-brn) resistor by the body as shown and bend the leads straight down with your finger to fit the hole spacing on the circuit board.

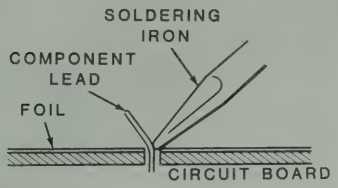


( ) R101: Start the leads into the holes at the resistor's circuit board location. The end with color bands may be positioned either way. NOTE: Resistors are identified by the following circuit board outline:

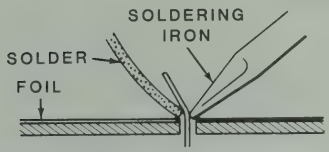


( ) Press the resistor against the circuit board and bend the leads outward slightly to hold it in place.

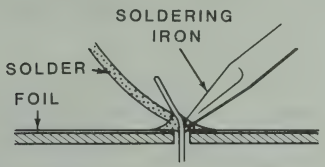
( ) Solder the leads to the circuit board as follows:



1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.

( ) Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

( ) Check each connection and compare it to the Illustrations in Detail 1-1A. After you have checked the solder connections, proceed with the assembly. Use the same soldering procedure for each connection.

Section 1

Start at the top of Section 1 of the Pictorial and install the following components on the circuit board. Make sure you installed resistor R101 on Page 9 in an earlier step.

( ) C101: .1 μF (104) axial-lead ceramic. NOTE: You can install this capacitor in either direction on the circuit board.

( ) R109: 4700 Ω (yel-viol-red).

( ) R114: 4700 Ω (yel-viol-red).

( ) R102: 510 Ω (grn-brn-brn).

( ) R103: 510 Ω (grn-brn-brn).

( ) R115: 4700 Ω (yel-viol-red).

( ) R116: 4700 Ω (yel-viol-red).

( ) Cut four 1″ lengths of bare wire.

( ) W102: 1″ bare wire.

( ) W103: 1″ bare wire.

( ) W104: 1″ bare wire.

( ) W105: 1″ bare wire.

( ) R104: 510 Ω (grn-brn-brn).

( ) R105: 510 Ω (grn-brn-brn).

( ) R117: 4700 Ω (yel-viol-red).

( ) R118: 4700 Ω (yel-viol-red).

( ) Solder the leads to the foil and cut off the excess lead lengths.

Section 2

( ) R106: 510 Ω (grn-brn-brn).

( ) R107: 510 Ω (grn-brn-brn).

( ) R119: 4700 Ω (yel-viol-red).

( ) Cut four 1" lengths of bare wire. Do not discard the remaining length of bare wire. It will be used later in the "Initial Tests" section.

( ) W108: 1" bare wire.

( ) W101: 1" bare wire.

( ) W106: 1" bare wire.

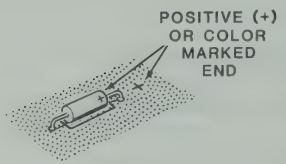
( ) W107: 1" bare wire.

( ) R121: 4700 Ω (yel-viol-red).

( ) R108: 510 Ω (grn-brn-brn).

( ) R112: 1800 Ω (brn-gray-red).

( ) C102: 1 μF tantalum capacitor. Be sure to install the positive (+) lead in the positive-marked hole as shown below.



( ) R111: 510 Ω (grn-brn-brn).

( ) R113: 4700 Ω (yel-viol-red).

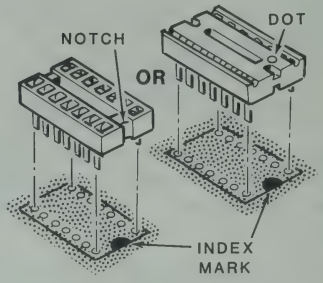
( ) R122: 4700 Ω (yel-viol-red).

( ) Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 1-2 for the following steps.

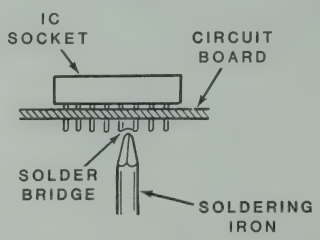
NOTES:

1. To install an IC socket, make sure the pins are straight. If there is any kind of identification mark (notch, dot, arrowhead, etc.) at or near one end of the socket, place this marked end toward the index mark on the circuit board (this index mark should still be visible after you install the socket). Then start the pins into the circuit board holes and solder them to the foil.



2. It is very easy to form a solder bridge between foils when you solder IC pins. After you install an IC socket, carefully inspect the foil for solder bridges and remove any that you find, as described below. If you suspect that you have a solder bridge but are not positive, you can check your foil pattern against the "X-Ray View" shown on Page 26.

3. To remove a solder bridge, hold the circuit board component-side-up as shown and hold your soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.



Install IC sockets in the circuit board at the following locations.

( ) 16-pin IC socket at U101.

( ) 14-pin IC socket at U103.

( ) 16-pin IC socket at U102.

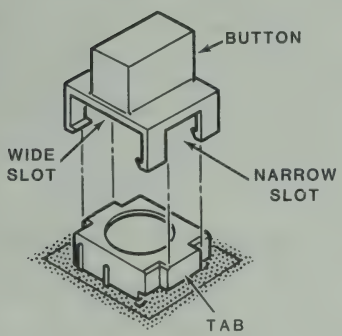
( ) 14-pin IC socket at U104.

( ) Cut off and discard pin 5 from the 7-pin plug as shown in the Pictorial.

( ) P101: 7-pin plug. Be sure to position this plug as shown in the Pictorial.

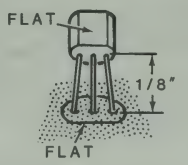
( ) SW111: pushbutton switch (#64-946). Insert the leads of the switch into the corresponding circuit board holes. Then push the switch down against the circuit board and solder the leads to the foil.

( ) Install a button on SW111. Position it over the switch as shown below. Then push the button down over the switch until it snaps into place.



Refer to Pictorial 1-3 for the following steps.

NOTE: When you install the following IC, position it so the flat side of the case is over the outline of the flat on the circuit board, as shown below. Then insert the leads into their holes and position the bottom of the case 1/8″ above the circuit board. Solder the leads to the foil and cut off any excess lead lengths.



( ) U105: 78L05 integrated circuit (#442-627).

NOTE: To install a switch, as in the following steps, insert the lugs into the corresponding circuit board holes. Then push the switch down against the circuit board and solder the leads to the foil.

Install 3-position slide switches (#60-659) at the following nine locations:

( ) SW101.

( ) SW102.

( ) SW103.

( ) SW104.

( ) SW105.

( ) SW106.

( ) SW107.

( ) SW108.

( ) SW109.

( ) SW112: 2-position slide switch (#60-660).

Refer to Pictorial 1-4 for the following steps.

Refer to Detail 1-4A for the next six steps and install eight red LEDs and one green LED as follows:

( ) 1. Insert the leads of eight red LEDs into their circuit board holes at V101, V102, V103, V104, V105, V106, V107, and V108. Be sure to position each LED with its long lead as shown. Do not solder the leads to the circuit board foils at this time.

( ) 2. In the same manner, insert the leads of the green LED at V109.

( ) 3. Temporarily mount the front panel to the circuit board as shown. Use two 4-40 × 1/2" phillips screws in opposite corners of the circuit board as shown. Do not tighten the screws.

( ) 4. Position each LED so its top protrudes through its respective front panel hole and rests against your work surface. The row of switches will properly space the LEDs.

( ) 5. Solder the LED leads to the circuit board foils and cut off the excess lead lengths.

( ) 6. Remove the front panel and set it and the screws aside until they are called for in a later step.

Refer to Pictorial 1-5 for the following steps.

( ) Refer to Detail 1-5A and separate the individual wires for the outer length of the 25-wire flat cable into the following cables:

Two 8-wire cables consisting of:	Two 2-wire cables consisting of:	A single black wire.	A 4-wire cable consisting of:
brown	white		brown
red	black		red
orange			orange
yellow			yellow
green			
blue			
violet			
gray			

NOTE: You can discard one of the 8-wire cables and the 4-wire cable.

Refer to Detail 1-5B for the next three steps.

( ) 1. Cut either of the black and white cables to 4" long. You can discard the remaining 8" length of cable.

( ) 2. Separate the individual wires at each end of the 4" cable for 3/4".

( ) 3. Remove 1/4" of insulation from each wire end. Twist together the strands at each wire end and apply a small amount of solder to hold the strands together.

Connect either end of the 4" cable to the circuit board as follows:

( ) White wire to hole A.
( ) Black wire to hole B.
( ) Solder the leads to the foil and cut off the excess lead length.

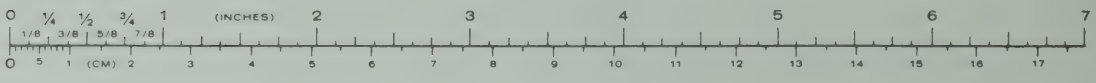
NOTE: In the following steps, (NS) means not to solder because you will add other wires later. "S-" with a number, such as (S-2), means to solder the connection. The number following the "S-" tells you how many wires should be at the connection. This helps you check your work for errors as you go.

Connect the free end of the 4" cable to eliminator jack J1 as follows:

( ) White wire to lug 1 (S-1).
( ) Black wire to lug 2 (NS).

( ) Connect the black wire from the battery connector to battery eliminator jack J1 lug 2 (S-2).

( ) Connect the red wire from the battery connector to battery eliminator jack J1 lug 3 (S-1).



NOTE: In the following steps, you will prepare and install the 8-wire cable and a separate black wire that are used as the input lines. For optimum performance when you are checking high speed circuits, cut these cables to 6". For low speed circuitry and ease of use, keep these cables at 12".

Refer to Detail 1-5C for the next five steps.

( ) 1. If you desire, cut the 8-wire cable to 6" long.

( ) 2. Separate the individual wires at either end of the cable for a distance of 3/4".

( ) 3. Remove 1/4" of insulation from each wire end. Twist together the strands at each wire end and apply a small amount of solder to hold the strands together.

( ) 4. Separate the individual wires at the remaining end of the cable for 3".

( ) 5. Remove 1/4" of insulation from each wire end. Twist together the strands at each wire end and apply a small amount of solder to hold the strands together.

( ) If you are using a 6" 8-wire cable, cut the black wire to 6".

( ) Remove 1/4" of insulation from each end of the black wire. Twist together the strands at each wire end and apply a small amount of solder to hold the strands together.

Refer to Detail 1-5D for the next five steps and install a micro clip on each wire at the 3" end of the 8-wire cable and on the black wire. The micro clips may be either of the two types shown.

( ) 1. Pull the cap off the tip of a micro clip.

( ) 2. Route the black wire through the hole in the cap.

( ) 3. Solder the black wire to the lug on the tip of the micro clip. Be sure to keep the solder connection as small as possible. Otherwise, the cap may not fit over the lug when you install it in the next step.

( ) 4. Cut off any excess wire length and push the cap back onto the micro clip. Be sure to line up the ridge on the tip with the notch in the cap. Temporarily set the black wire aside.

( ) 5. In the same manner, install a micro clip on each of the wires on the 8-wire cable.

NOTE: In the following steps, you will connect the free end of the 8-wire cable and the black wire to the circuit board holes. Solder each wire to the foil as you connect it and cut off any excess lead length.

Connect the free end of the 8-wire cable and the black wire to the circuit board as follows:

( ) Black wire to hole C.

( ) Gray wire to hole M.

( ) Violet wire to hole L.

NOTE: Do not connect any wires to hole F.

( ) Blue wire to hole K.

( ) Green wire to hole J.

( ) Yellow wire to hole H.

( ) Orange wire to hole G.

( ) Red wire to hole E.

( ) Brown wire to hole D.

Refer to Pictorial 1-6 for the following steps.

NOTE: Some of the ICs used in this kit are MOS (metal-oxide semiconductor) devices. These are rugged and reliable components when they are installed, but they can be damaged by static electricity during installation. The other ICs are of a type that is not susceptible to static electricity. However, you should treat these ICs as if they were MOS types, since it will avoid all possible confusion between ICs and provide protection in all cases.

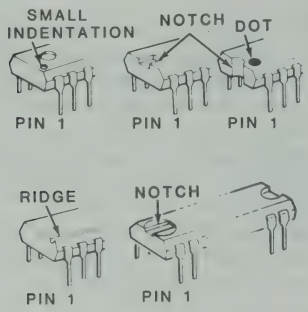
Once you remove a protected IC from its protective foam packing, DO NOT lay the IC down or let go of it until it is installed in its socket. When you bend the leads of a protected IC, hold it in one hand and place your other hand on your work surface before you touch the IC to your work surface. This will equalize the static electricity between the work surface and the IC.

The pins on the IC may be bent out at an angle, so they do not line up with the holes in the IC socket. DO NOT try to install an IC without first bending the pins as described below. To do so may damage the IC pins or the socket, causing intermittent contact.

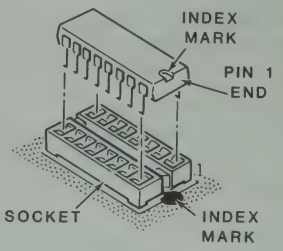
Before you install an IC:

1. Lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.

2. Compare the IC to the drawing below. Then determine which end of the IC is the pin 1 end.



3. Position the pin 1 end of the IC over the index mark on the circuit board (refer to the Pictorial if you cannot find the index mark on your circuit board). Then start the IC pins into the socket. Make sure that all of the pins are started; then push the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.



( ) U103: 74ALS30 integrated circuit (#443-1231).

( ) U101: 74HC75 integrated circuit (#443-1288).

( ) U102: 74HC75 integrated circuit (#443-1288).

( ) U104: 74LS132 integrated circuit (#443-792).

CIRCUIT BOARD CHECKOUT

Carefully inspect the foil side of the circuit board for the following most-commonly-made errors.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together or touch the chassis when the circuit board is installed later.

Refer to the illustrations where parts are installed as you make the following visual check:

( ) ICs for the proper type and installation.

This completes the assembly of the circuit board. Proceed to the "Initial Tests" section.

INITIAL TESTS

In this section of the Manual, you will perform certain tests to verify that your Byte Probe operates properly. If you do not obtain the correct results in any of the following tests, refer to the "In Case of Difficulty" section on Page 21.

Refer to Pictorial 2-1 for the following steps.

( ) 1. Set ON-OFF switch SW112 to its bottom (OFF) position.

( ) 2. Set INPUT switches SW101 through SW108 to their center (X) position.

( ) 3. Set TIME switch SW109 to its top (REAL TIME) position.

( ) 4. Connect all nine micro clips to the remaining length of bare wire. This provides a ground (logic "0") to the inputs.

( ) 5. Connect your Byte Probe to a 9-volt transistor battery or battery eliminator.

( ) 6. Set ON-OFF switch SW112 to its top (ON) position. You should observe the following conditions:

Bit Indicators V101 through V108 are OFF.
Coincidence Indicator V109 is ON.

( ) 7. Remove the micro clip on the brown wire from the bare wire and connect it to the indicated lead of R101(+ 5 volts = logic 1). Bit Indicator V101 should be ON and Coincidence Indicator V109 should be ON.

( ) 8. Set INPUT switch SW101 to its bottom (0) position. Bit Indicator V101 should remain ON and Coincidence Indicator V109 should go OFF.

( ) 9. Set INPUT switch SW101 to its top (1) position. Bit Indicator V101 should remain ON and Coincidence Indicator V109 should go ON.

( ) 10. Remove the micro clip on the brown wire from R101 and reconnect it to the bare wire.

( ) 11. Set INPUT switch SW101 to its center (X) position.

( ) 12. Repeat steps 7 through 11 for each of the other seven wires with micro clips. **DO NOT** connect the micro clip on the black wire to R101. Be sure to return the INPUT switch being tested to its center (X) position before continuing on with the next input.

NOTE: Perform the following test only after all eight input lines have been tested (you have performed steps 7 through 11 for all eight input lines).

( ) Set ON-OFF switch SW112 to its OFF (bottom) position.

( ) Set INPUT switch SW101 to its logic 0 (bottom) position.

( ) Set TIME switch SW109 to its LATCH (bottom) position.

( ) If it has not already been done, make sure all eight input lines and the ground line are all connected to the bare wire.

( ) Set ON-OFF switch SW112 to its ON (top) position.

( ) Press RESET switch SW111. Bit Indicators V101 through V108 should be OFF and Coincidence Indicator V109 should be ON.

( ) Remove the brown input micro clip from the bare wire and connect it to the indicated lead of R101. Bit Indicators V101 through V108 should remain OFF and Coincidence Indicator V109 should remain ON.

( ) Press RESET switch SW111. Bit Indicator V101 should go ON, Bit Indicators V102 through V108 should remain OFF, and Coincidence Indicator V109 should go OFF.

( ) Set ON-OFF switch SW112 to OFF, remove the micro clips from the bare wire, and R101 and proceed to "Final Assembly".

FINAL ASSEMBLY

CABINET INSTALLATION

Refer to Pictorial 3-1 for the following steps.

( ) Position the circuit board as shown in the Pictorial.

( ) Remove the paper backing from a 2" length of foam gasket and press the gasket to the circuit board as shown in the Pictorial.

( ) If it has not already been done, remove the nut and flat washer from battery eliminator jack J1.

( ) Mount J1 to the side panel as shown in the inset drawing. Use the nut and flat washer supplied with the jack.

( ) Mount the front panel to the circuit board with four 4-40 × 1/2" phillips head screws. Be sure to line the holes in the front panel with the switches and LEDs on the circuit board.

Refer to Pictorial 3-2 for the following steps.

( ) Cut a 2" length of foam gasket in half to make two 1" lengths.

( ) Remove the paper backing from either length of foam gasket and press the gasket to the cabinet bottom on either side of the battery compartment as shown.

( ) Remove the paper backing from the remaining length of foam gasket and press the gasket to the cabinet bottom on the other side of the battery compartment as shown in the Pictorial.

( ) Remove the paper backing from the blue and white label and press the label to the cabinet bottom as shown. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

( ) Install the side panel with battery eliminator jack in the indicated side of the cabinet bottom as shown. Be sure to route the battery connector leads through the slot in the cabinet bottom to the battery compartment as shown in the Pictorial.

( ) Position the front panel / circuit board assembly in the cabinet bottom as shown. Be sure to line up the holes in the front panel with the bosses in the cabinet bottom. Route the 8-wire flat cable and black wire through the cutout in the side panel as shown.

( ) Mount the cabinet top to the cabinet bottom as shown in the Pictorial. Use four 4-40 × 3/8" self-tapping screws. Do not overtighten the screws or you may strip the cabinet holes.

NOTE: You may discard the plastic cabinet side. It will not be used.

CABLE PREPARATION

Refer to Pictorial 3-3 for the following steps.

( ) Refer to Detail 3-3A and prepare the free end of the cable assembly as shown.

( ) Install a spring connector on the inner lead on the free end of the cable assembly as shown.

( ) In a similar manner, install a spring connector on the shield lead of the free end of the cable assembly.

( ) Position a 2-pin connector shell as shown in the Pictorial.

( ) Push the spring connector on the end of the inner lead into a 2-pin connector shell hole 2 until it snaps into place.

( ) Push the spring connector on the end of the shield lead into the 2-pin connector shell hole 1 until it snaps into place.

Refer to Pictorial 3-4 for the following steps.

( ) Locate the remaining 2-wire (black and white) cable.

Refer to Detail 3-4A for the next two steps.

( ) 1. Separate the individual wires on each end of the 2-wire cable for 1/2".

( ) 2. Remove 1/8" of insulation from each wire end. Twist together the strands at each wire end and apply a small amount of solder to hold the strands together.

( ) Install a spring connector on each of the four wire ends as shown in the Pictorial.

( ) Position a 2-pin connector shell at cable end A as shown in the Pictorial.

( ) Push the spring connector on end A of the white wire into a 2-pin connector shell hole 1 until it snaps into place.

( ) Push the spring connector on the black wire on end A into the 2-pin connector shell hole 2 until it snaps into place.

( ) Position a 2-pin connector shell at cable end B as shown in the Pictorial.

( ) Push the spring connector on end B of the white wire into a 2-pin connector shell hole 2 until it snaps into place.

( ) Push the spring connector on end B of the black wire into the 2-pin connector shell hole 1 until it snaps into place.

This completes the assembly of your ID-4804 Byte Probe. Proceed to the "Operation" section.

OPERATION

This section of the Manual is divided into five sections: Operating Precautions, General Operating Characteristics, Single Probe Operation, Multiple Probe Operation, and Trigger Operation.

OPERATING PRECAUTIONS

1. Verify that the circuit you are testing is operating from a +5 VDC supply and has standard TTL levels. If the inputs to the Byte Probe are in an indeterminate state (1.0 V to 2.0 V), the Bit Indicators may be ON or OFF erratically.

2. Always terminate unused input lines. Unterminated input lines will display random indications. Terminate input lines by connecting them to either circuit ground or +5 volts.

3. When you are using the Trigger Input from an external source, make sure the source (oscillator gate, microprocessor, etc.) is capable of driving an additional TTL load.

4. Except in the Latch Mode, a low duty cycle input may cause the Bit Indicators to appear to be ON or OFF (logic 1 or logic 0) even though the input signal is switching. To check for this condition, set the TIME switch to PULSE and the INPUT switch(es) in question to the opposite condition as the Bit Indicator indicates. Set the remaining switches to "X". If a low duty cycle change occurs, Coincidence Indicator V109 will go ON. For example, if Bit Indicator V101 is ON, set INPUT switch SW101 to logic 0 and switches SW102 through SW108 to "X". If the input line is switching low, V109 will go ON.

GENERAL OPERATING CHARACTERISTICS

Refer to Pictorial 4-1 for the location of your Byte Probe's switches, indicators, and connectors.

Input switches SW101 through SW108 are used to program the Probe for a specific logic condition (combination of logic 1 and/or logic 0) or for data acquisition (X). When the input switches are programmed for a specific logic condition, Coincidence Indicator V109 will go ON only when this logic condition is fulfilled (coincidence occurs). In the X position, coincidence is not effected by that channel. However, that channel's Bit Indicator will display the status of the input.

TIME switch SW109 is used to select one of three time modes: REAL TIME, PULSE TIME, or LATCH TIME. In the REAL TIME position, Bit Indicators V101 through V108 turn ON and OFF at the same rate as the input is switching. Therefore, when you are testing a fast circuit, you may not be able to observe V101 through V109 turning ON and OFF.

When the TIME switch is in the PULSE TIME position, a timing circuit "stretches" the display time for approximately 500 ms each time a coincidence occurs. This allows the Bit Indicators and Coincidence Indicator to remain latched for 500 ms after coincidence occurs, making it easier to observe pulse transitions. After approximately 500 ms, the inputs are reset and ready for the next occurrence.

When the TIME switch is in the LATCH TIME position, the state of all inputs is latched at coincidence. The outputs will remain latched until you manually reset the Probe by pushing RESET switch SW111. Always press the RESET switch prior to testing a circuit when you use the Latch Time Mode. This will reset the Probe's latch circuitry to its correct state.

NOTE: The LEDs may light when the Probe is connected to a TTL high signal, even when the power switch is off.

Plug P101 provides the trigger Input and Output connections to your Byte Probe. P101 pins 1, 3, and 7 are circuit ground. P101 pins 2 and 4 are the trigger Outputs. P101 pin 6 is the trigger Input. When you are using the trigger function in a master – slave configuration, the master probe will trigger first. Therefore, use the master probe to trigger your external device. When you are using the trigger function in a slave – slave configuration, all of the probes will trigger simultaneously. Therefore, you can use any of the probes to trigger your external device.

Finding a Loop in a Program

Your Byte Probe can be used to detect when a system is in a program loop. To find a loop in a program, use the following procedure:

1. Set the TIME switch to its REAL TIME position.
2. Connect each micro clip and program switches SW101 through SW108 to the data byte (instruction) in the area of the program that you believe is looping.
3. Observe Coincidence Indicator V109 to see how brightly it lights. If it is lit brightly, the programmed instruction is looping frequently in your program. If it is lit dimly the programmed instruction is looping less frequently.

SINGLE PROBE OPERATION

1. Turn OFF your Byte Probe.
2. If possible, turn OFF the unit to be tested. If this unit cannot be turned OFF, be careful not to accidentally short adjacent lines together.
3. Connect the micro clip on the black input lead to ground of the circuit being tested.
4. Connect the micro clips on the Probe's input leads to the lines to be tested. Be sure not to short any adjacent lines together.
5. Program the INPUT switches for the logic condition you desire: logic 1, logic 0, or X for data acquisition.
6. Set the TIME switch to the time mode you desire: REAL TIME, PULSE TIME, or LATCH TIME.
7. Turn ON your Byte Probe.
8. If your Probe is programmed for data acquisition (X), observe Bit Indicators V101 through V108 to determine the status of the lines being tested.
9. If your Probe is programmed for a specific logic condition (combination of logic 1 and logic 0), observe Coincidence Indicator V109 to determine if that logic condition (coincidence) has occurred.

MULTIPLE PROBE OPERATION

Master – Slave Configuration

The following paragraphs will explain the use of two Byte Probes. However, you can interconnect more than two Probes together if you desire to test more than 16 lines.

1. Program and connect each Byte Probe to the lines to be tested as outlined in the "Single Probe Operation" section.
2. Refer to Pictorial 4-2 Part A and connect the Trigger Output of the first Byte Probe (master unit) to the Trigger Input of the second Byte Probe (slave unit).
3. If your Probes are programmed for data acquisition (X), observe Bit Indicators V101 through V108 on each Probe to determine the status of the lines being tested.
4. If your Probes are programmed for a specific logic condition, observe each Coincidence Indicator (V109) to determine if that logic condition (coincidence) has occurred. Note that coincidence must occur in the master probe before it can occur in the slave probe. Coincidence in the slave probe can last only as long as the master probe remains in coincidence.

The Master-Slave Configuration is helpful in locating "cause and effect" conditions in a circuit or program. Note that coincidence must occur in the master probe before it can occur in the slave probe. To locate cause and effect conditions, use the following procedure.

1. Program bit switches SW101 through SW108 in the master probe for a set of conditions or a bit pattern that is occurring in the unit under test.

2. Program bit switches SW101 through SW108 in the slave probe to their "X" (don't care) positions.

3. Connect the Trigger Output of the master probe to the Trigger Input of the slave probe.

4. Observe coincidence indicator V109 in the master probe and bit indicators V101 through V108 in the slave probe. When coincidence occurs in the master probe, bit indicators V101 thorugh V108 will display the logic states of its inputs.

NOTE: If there is a significant delay between the master bit pattern occurrance and the data you wish to capture, set one or two of the bit switches (SW101 through SW108) on the slave probe to their "1" or "0" positions to ensure that you are displaying valid data. Another way to verify data is to connect one input of the slave probe to a read, write, or some other pulse that is coincident with the desired data.

Slave–Slave Configuration

The following paragraphs will explain the use of two Byte Probes. However, you can interconnect more than two Probes together if you desire to test more that 16 lines.

Note that coincidence must occur in all Probes simultaneously to turn on any of the Coincidence Indicators.

1. Program and connect each Byte Probe to the lines to be tested as outlined in the "Single Probe Operation" section.

2. Refer to Pictorial 4-2 Part B and connect the Trigger Output of the first Byte Probe to the Trigger Input of the second Byte Probe.

3. Connect the Trigger Output of the last Byte Probe to the Trigger Input of the first Byte Probe as shown in Pictorial 4-2 Part B.

4. If your Probes are programmed for data acquisition (X), observe Bit Indicators V101 through V108 on each probe to determine the status of the lines being tested.

5. If your Probes are programmed for a specific logic condition, observe each Coincidence Indicator (V109) to determine if that logic condition (coincidence) has occurred.

TRIGGER OPERATION

The following paragraphs will explain the use of both the Trigger Input and Trigger Output features. However, you can use the Trigger Input and Trigger Output features independently of each other.

When you are using the Trigger Function in a master - slave configuration, the master probe will trigger first. Therefore, use the master probe to trigger your external device. When you use the Trigger Function in a slave - slave configuration, all of the probes will trigger simultaneously. Therefore, you can use any of the probes to trigger your external device.

1. Program and connect your Byte Probe(s) to the lines to be tested as outlined in the "Single Probe Operation" or "Multiple Probe Operation" sections.

2. Refer to Pictorial 4-2 Part C and connect the Trigger Output of your Byte Probe to the Trigger Input of your external device (an oscilloscope is used as the example in the pictorial).

3. If you are using an external TTL signal as a trigger, connect it to the Trigger Input.

4. Your Byte Probe will function as outlined previously. However, your Probe will trigger or be triggered by the external device.

IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct difficulties that might occur in your Byte Probe. This information is divided into the "Visual Checks," "Precautions for Troubleshooting," and a "Troubleshooting Flow Chart." Use the Visual Checks to locate any difficulties that may occur right after the unit is assembled. Use the "Troubleshooting Flow Chart" to narrow down the problem to a specific area in the Probe. Then apply the Visual Checks to that area. A "Circuit Board X-Ray View" is also provided on Page 26 to help you locate parts on the circuit board.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

VISUAL CHECKS

1. Recheck the wiring. Trace each lead with a colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered as described in the soldering instructions on Page 10, and in Detail 1-1A. Be sure there are no solder "bridges" between circuit board foils.

3. Check the tantalum capacitor to be sure its positive (+) lead is at the correct position.

4. Check to be sure each IC is properly installed in its socket and pins are not bent out or under the IC. Also be sure the IC's are installed in their correct positions.

5. Check the values of the parts. Be sure in each step that you wired the correct part into the circuit, as shown in the Pictorial.

6. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

7. A review of the "Circuit Description" may also help you determine where the trouble is.

If you still have not located the trouble after the "Visual Checks" are complete and a voltmeter is available, check voltage readings against those shown on the Schematic. Read the "Precautions for Troubleshooting" before you make any measurements.

PRECAUTIONS FOR TROUBLESHOOTING

NOTE: To perform some of the following tests, you will need a VTVM, VOM, DVM, or an oscilloscope. Connect your test instrument's common lead to the micro clip on the black lead.

1. Use caution when you test IC circuits. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.

2. Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across terminals or voltage sources, it is very likely to cause damage to one or more IC's.

TROUBLESHOOTING FLOW CHART

The "Troubleshooting Flow Chart" (Illustration Booklet, Page 9) will help you locate and identify possible causes of some problems you might encounter. To use this Chart, begin at one of the three START boxes, depending on where your problem occurred. Perform the steps and tests listed in each box. Pay particular attention to make sure that you preset switches or attach probes to the test points indicated. If you obtain the expected results in a particular box, follow the YES line and continue with the tests in the next box. If you do not obtain the expected results, follow the NO line and continue with the tests. The NO results will eventually lead to a box of possible causes.

If a particular part is mentioned (U103 for example) as a possible cause, check that part and other components connected to it to see that they are installed and/or wired correctly. Also check for solder bridges and poor connections in the surrounding area. It is also possible, on rare occasions, for a part to be faulty and require replacement.

NOTE: In the Troubleshooting Flow Chart, > means greater than.

SPECIFICATIONS

Pulse Repetition Rate	10 Mhz typical, 8 Mhz minimum
Input	Two 4-channel, high speed, CMOS RS latches.
Input to Trigger Output Delay	40 ns maximum.
Latching Pulse Width	25 ns minimum.
Display Modes	Real time, Pulse time, and Latch time.
Power Requirements	9-volt transistor battery (NEDA 1604) or optional battery eliminator (Heath Model PS-2350).
Battery Operating Time	8 hrs. minimum (alkaline battery).
Cables	Nine micro clips: eight inputs and one ground.
Display	Eight red LEDs for input and one green LED for coincidence.
Dimensions	6″W × 3.3″ D × 1.4″ H (15.2 × 8.2 × 3.6 cm).
Weight	.6 lbs. (.27 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligations to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram while you read the following circuit description.

ICs U101 and U102 are 4-bit bistable latches that provide eight identical input channels. Each input channel can be selected to respond to logic 1 (high), logic 0 (low), or X (don't care) by switches SW101 through SW108. The logic level of each input channel is indicated by LEDs V101 through V108 respectively. Coincidence occurrences (when all eight inputs are equal to the specific logic condition specified by input switches SW101 through SW108) are indicated by LED V109. All switch outputs are combined in NAND gate circuit U103 and inverter U104C. The output of the summing circuit can be used to trigger additional Byte Probes or an oscilloscope. SW109 selects one of three modes: Real Time, Pulse Time, or Latch Time. In the Real Time mode, indications will last only as long as the pulses last. The Pulse Time mode extends (stretches) the indication time to approximately 500 ms when coincidence occurs. In the Latch Time mode, indications will last until the Probe is manually reset by SW111. Power is supplied by a 9-volt transistor battery or optional battery eliminator and regulated to +5 volts by regulator IC U105.

Since all eight input channels function identically, the following will describe only one of the channels with switch SW101 in the logic 1 position. Note that when Input switch SW101 is in the X (data acquisition) position, no pulse is coupled through SW101 to summing gate U103. In the X position, the input to U103 at pin 6 is held high by pull-up resistor R109.

When a logic 1 (high) pulse occurs at U101 pin 7, pin 9 will also be high and pin 8 will be the complement of the input (low). Pin 8 is also used to drive indicator V101 when pin 7 is high. As long as the enable lines of U101 (pins 4 and 13) are high, the output (pins 8 and 9) will change corresponding to the input (pin 7). With the enable lines low, the outputs will remain latched at their last level until the Probe is reset. The logic 1 level at U101 pin 9 is coupled to U103 pin 6 through SW101.

U103 functions as a summing gate used to combine the levels coming from the outputs of U101 and U102. With all of U103's inputs (pins 1 through 6 and 11 and 12) high, coincidence occurs and the output (pin 8) goes low. If any of U103's inputs are low, the output will remain high. This logic 0 (low) level output is applied to U104C pins 9 and 10, causing U104C pin 8 to go high. The output (pin 8) of U104 is used as the trigger output and is also applied to U104D pin 13.

U104D is also used as a summing gate. When the Byte Probe is used independently, U104D pin 12 is held high by pullup resistor R113 and the pulse applied to pin 13 controls the gate. When coincidence occurs, pin 13 goes high and pin 11 goes low. If an external pulse is applied to the trigger input (P101 pin 6), U104D pins 12 and 13 must both be high to allow pin 11 to go low. When U104D pin 11 goes low, coincidence LED V109 is turned on.

The pulse on U104D pin 11 is applied to U104A pin 1. U104A and U104B comprise a resettable latching circuit that controls the enable lines (pins 4 and 13) of input latches U101 and U102. When U104A pin 1 goes low, pins 3 and 5 go high.

Time switch SW109 determines the operating mode of the enable line (U101 and U102 pins 4 and 13). In the Real Time mode, SW109 ties U104B pin 4 low (ground). A logic 0 on U104B pin 4 holds U104B pin 6 high. This allows input latches U101 and U102 to change corresponding to the inputs.

When switch SW109 is in the Pulse Time mode, U104B pin 4 is coupled to timing circuit R112 and C102. C102 charges through R112 when U104 pin 6 is high. When coincidence occurs, a high is applied to U104B pin 5, causing pin 6 to go low. The low at U104B pin 6 will discharge C102 after approximately 500 ms. When C102 is discharged, a logic 0 applied to U104B pin 4 forces pin 6 high. This high resets the circuit to a ready state until the next coincidence occurrence. The period of time (500 ms) that pin 6 was low holds the input latches (U101 and U102) to the levels present when coincidence occurred.

When switch SW109 is in the Latch Time mode, U104B pin 4 is held high by pull-up resistor R122. When coincidence occurs, U104A pin 1 and U104B pin 6 go low. The high at pin 3, combined with the high at pin 4, causes pin 6 and U104A pin 2 to stay low. This reinforces the low at pin 1. Therefore, even when pin 1 goes high again, the circuit state does not change. This latches U101 and U102 to retain their logic state at the time coincidence occurred. U101 and U102 will remain latched until Reset switch SW111 is pushed, causing a logic 0 to be applied to U104B pin 4 and resetting the U104 A, B latch circuit.

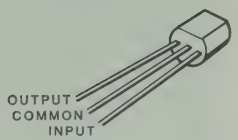
Power is supplied to your Byte Probe by a 9-volt transistor battery or optional battery eliminator to U105 pin "IN". U105 regulates this supply to 5 volts. Capacitor C101 filters the 5-volt supply.

SEMICONDUCTOR IDENTIFICATION CHART

INTEGRATED CIRCUITS

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
U101	443-1288	74HC75	A1
U102	443-1288	74HC75	A1
U103	443-1231	74ALS30	A2
U104	443-792	74LS132	A3
U105	442-627	78L05	A4

A4



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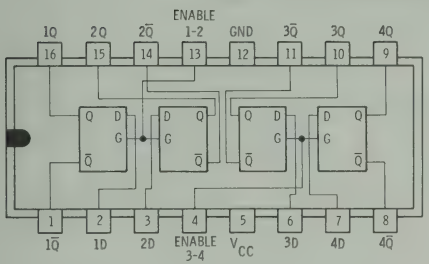

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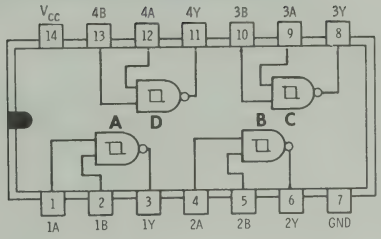

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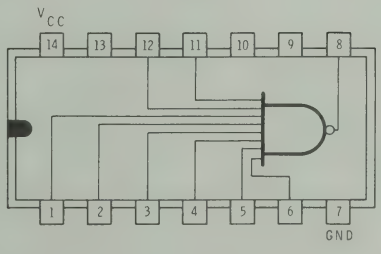


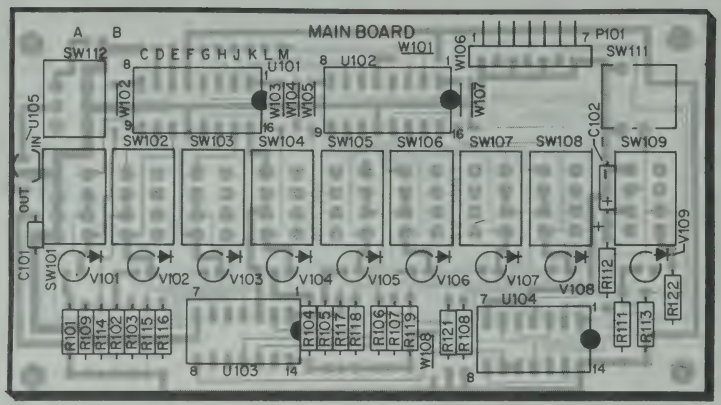
CIRCUIT BOARD X–RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R105, C103, etc.) on the X-RAY View.

B. Locate this same number in the "Circuit Component Number" column of the "Parts List".

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



(Shown from component side.)

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath/Zenith Computers and Electronics centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH/ZENITH COMPUTER AND ELECTRONICS CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath/Zenith Computer and Electronics centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath/Zenith Computer and Electronics center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? – Operation? — Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heath/Zenith Computer and Electronics center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heath/Zenith Computers and Electronics center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH ZENITH

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ILLUSTRATI

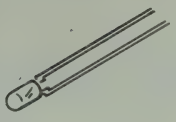
PARTS L

A1

A2

ALWAYS IDENTIFY AN IC BY THE PART NUMBER OR THE TYPE NUMBER
NOTE: THE STYLE MAY BE SLIGHTLY DIFFERENT THAN SHOWN.

A3



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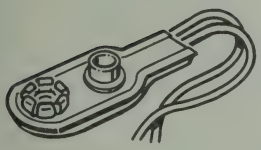
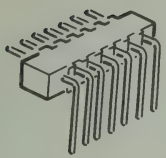


B2

B3

B4



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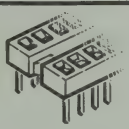
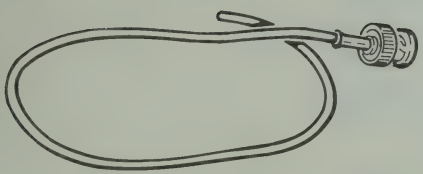


ALWAYS IDENTIFY AN I.C SOCKET BY COUNTING ITS PINS.
NOTE: THE STYLE MAY BE SLIGHTLY DIFFERENT THAN SHOWN.

B6

C1



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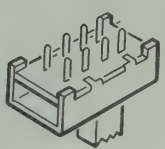

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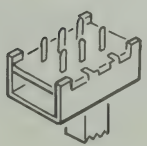

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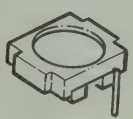

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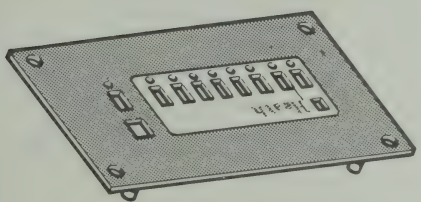

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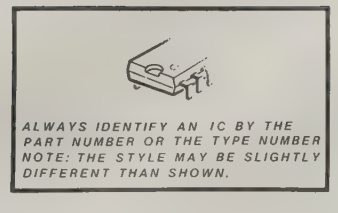
ILLUSTRATION BOOKLET

PARTS PICTORIAL

Part of 595-3464

A1

A2



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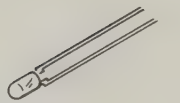

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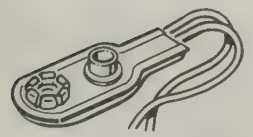

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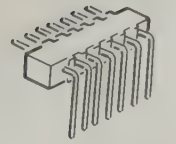

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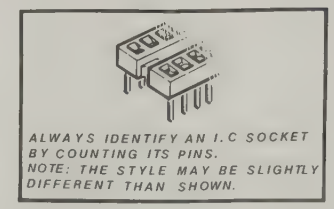

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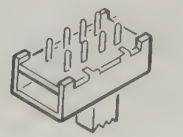

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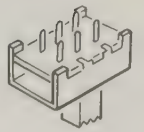

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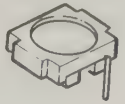

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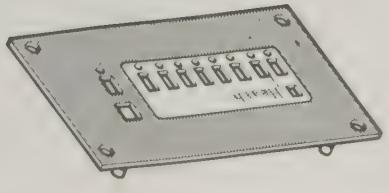
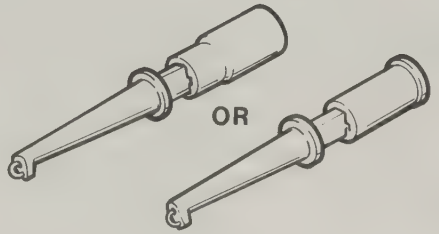


D5

D6

D7

D8



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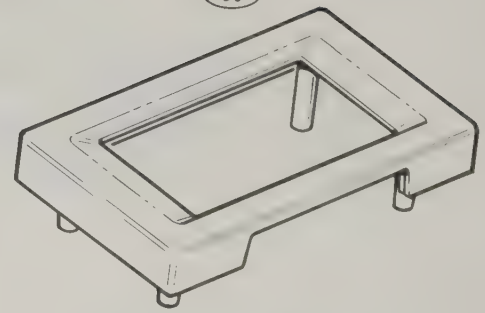

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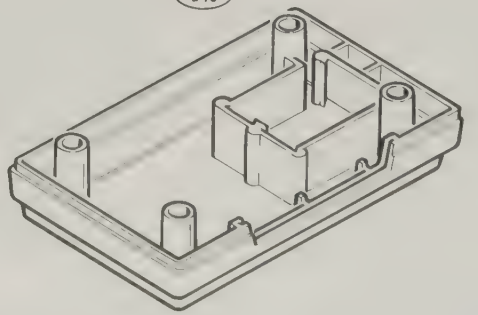

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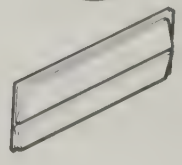

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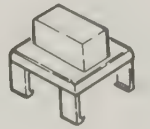
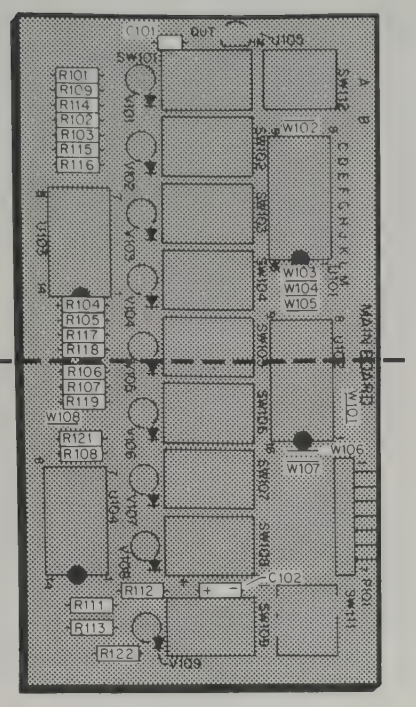


D13

D14

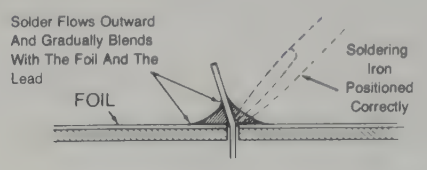
SECTION 1

SECTION 2



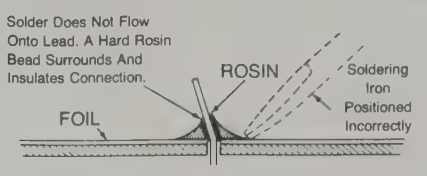
PICTORIAL 1-1

A GOOD SOLDER CONNECTION

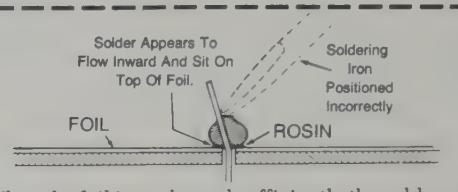


When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

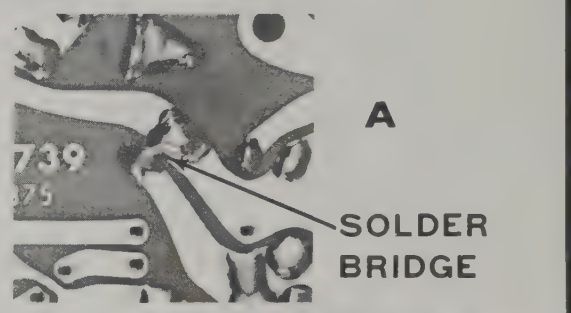


When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

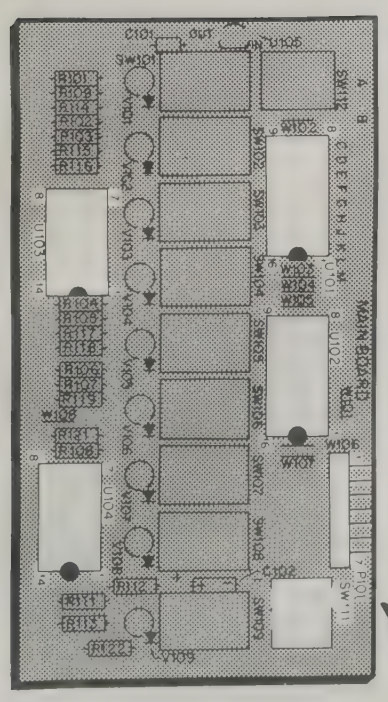
SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

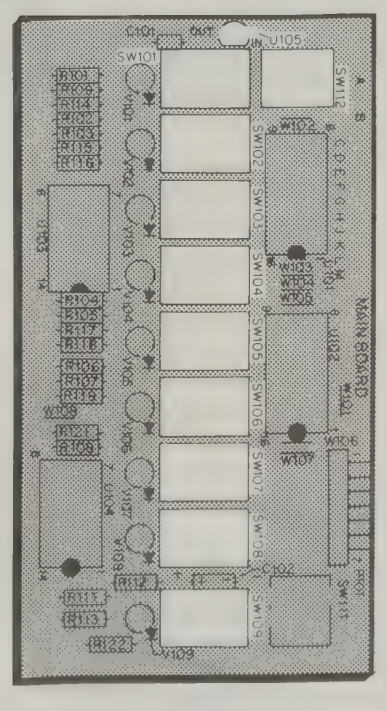
Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.



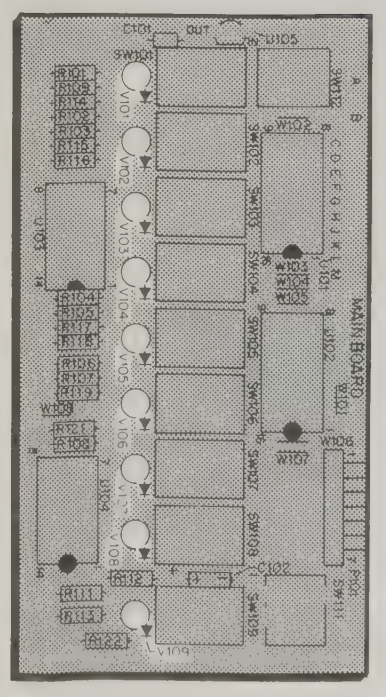
Detail 1-1A



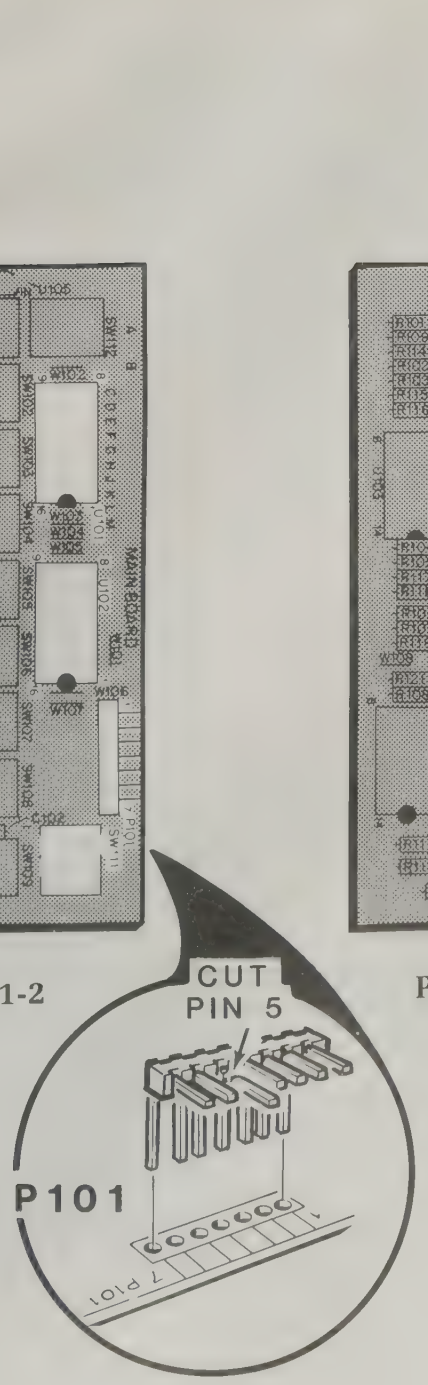
PICTORIAL 1-2

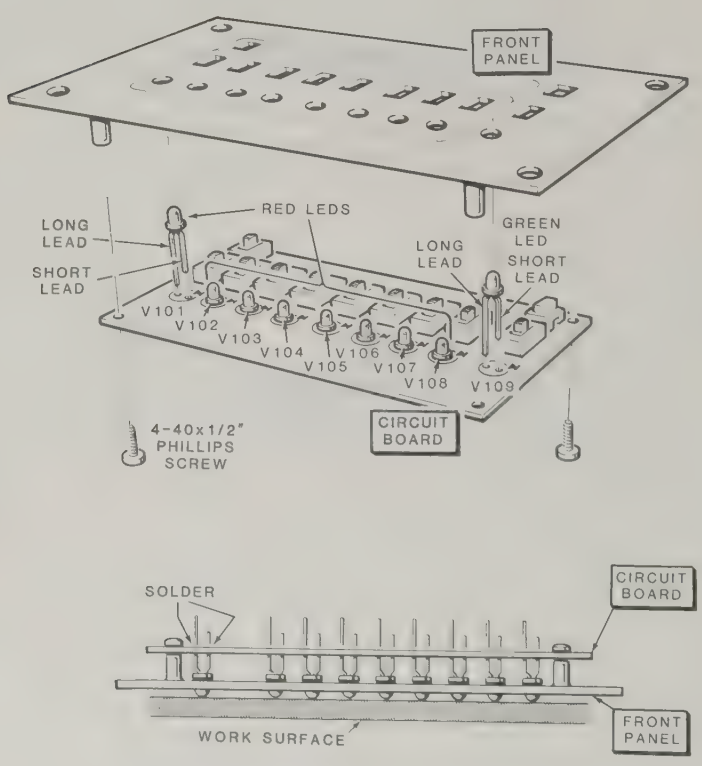


PICTORIAL 1-3

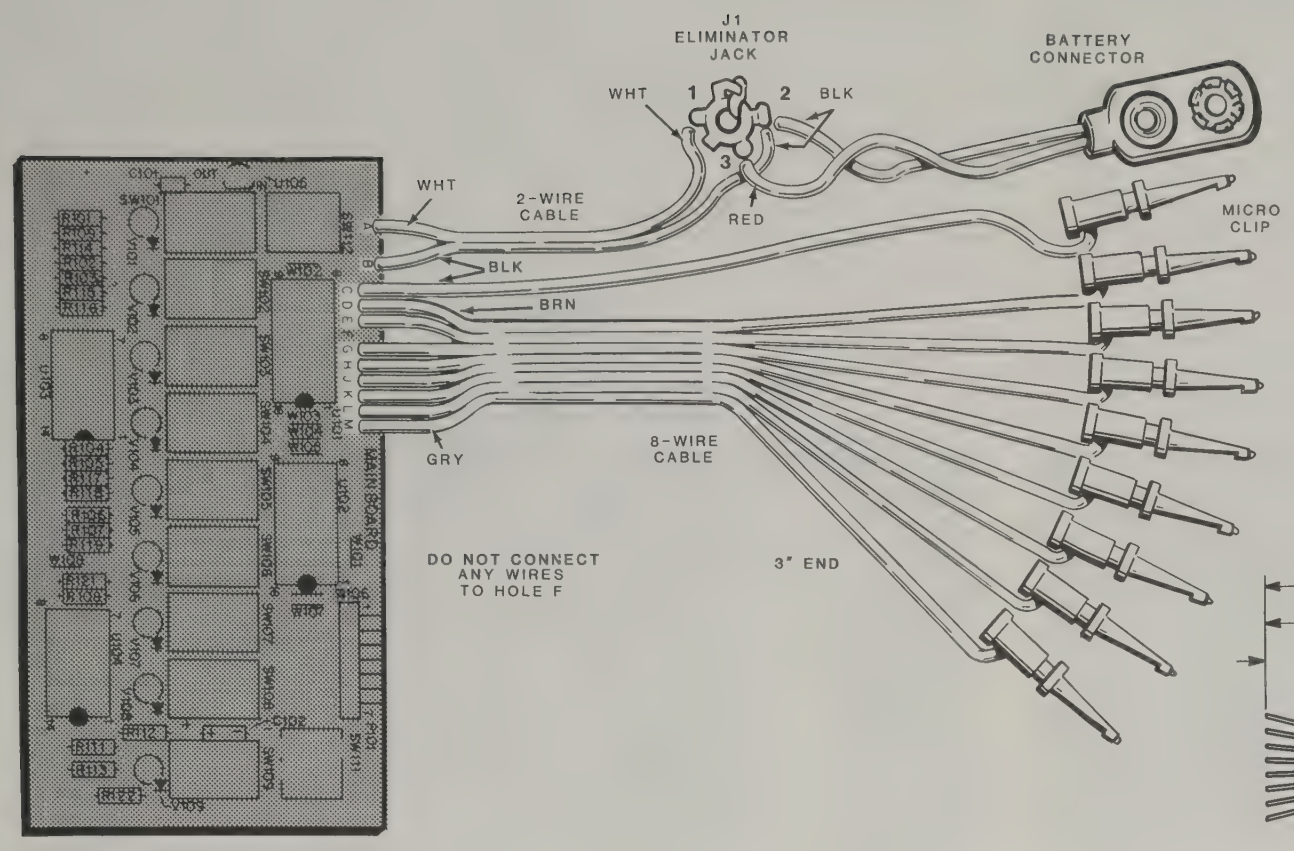


PICTORIAL 1-4

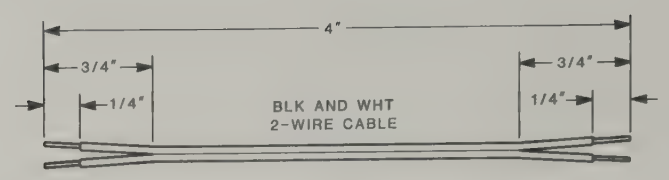




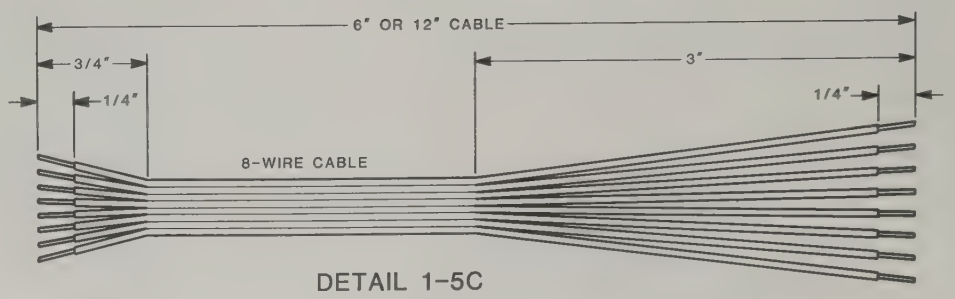
Detail 1-4A



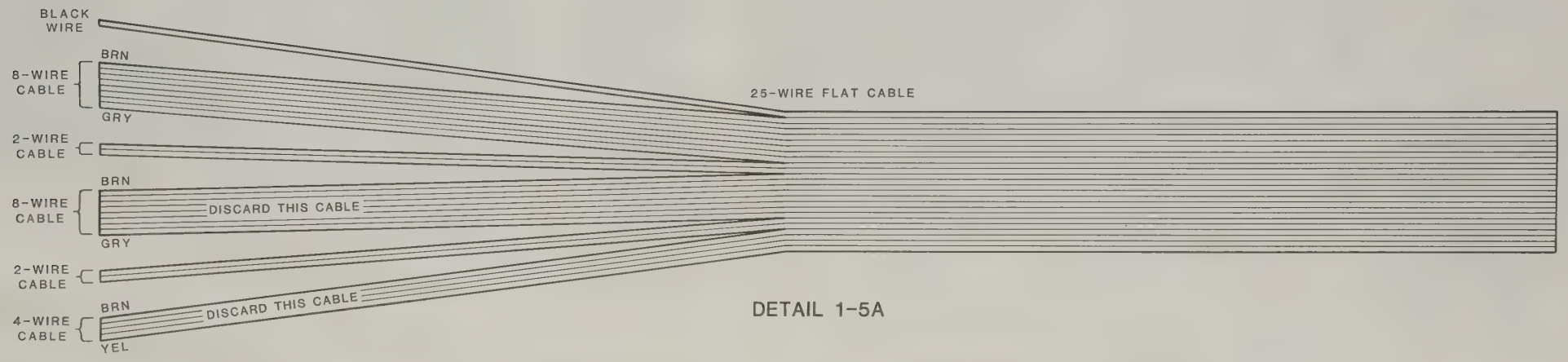
PICTORIAL 1-5



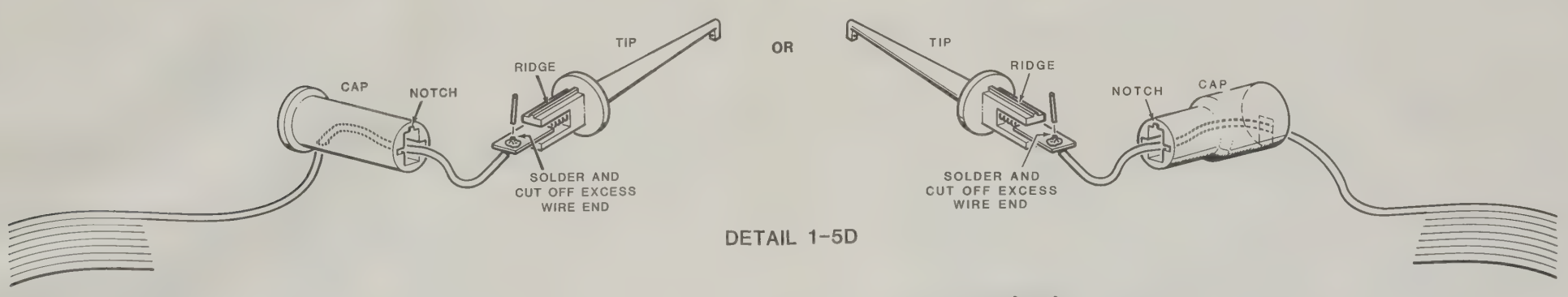
DETAIL 1-5B



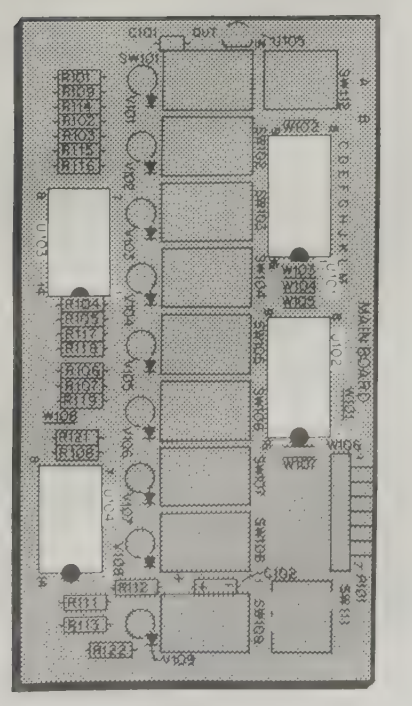
DETAIL 1-5C



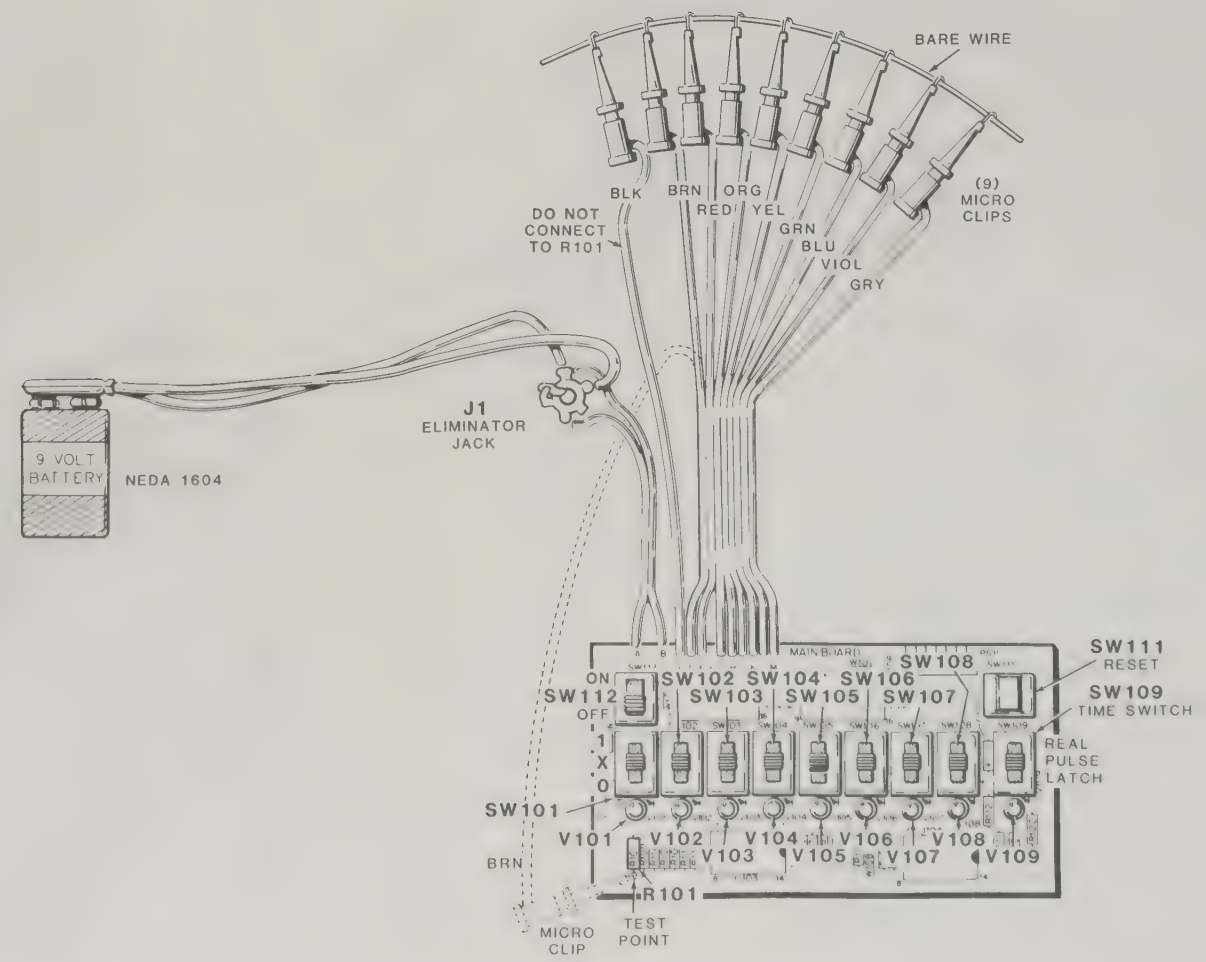
DETAIL 1-5A



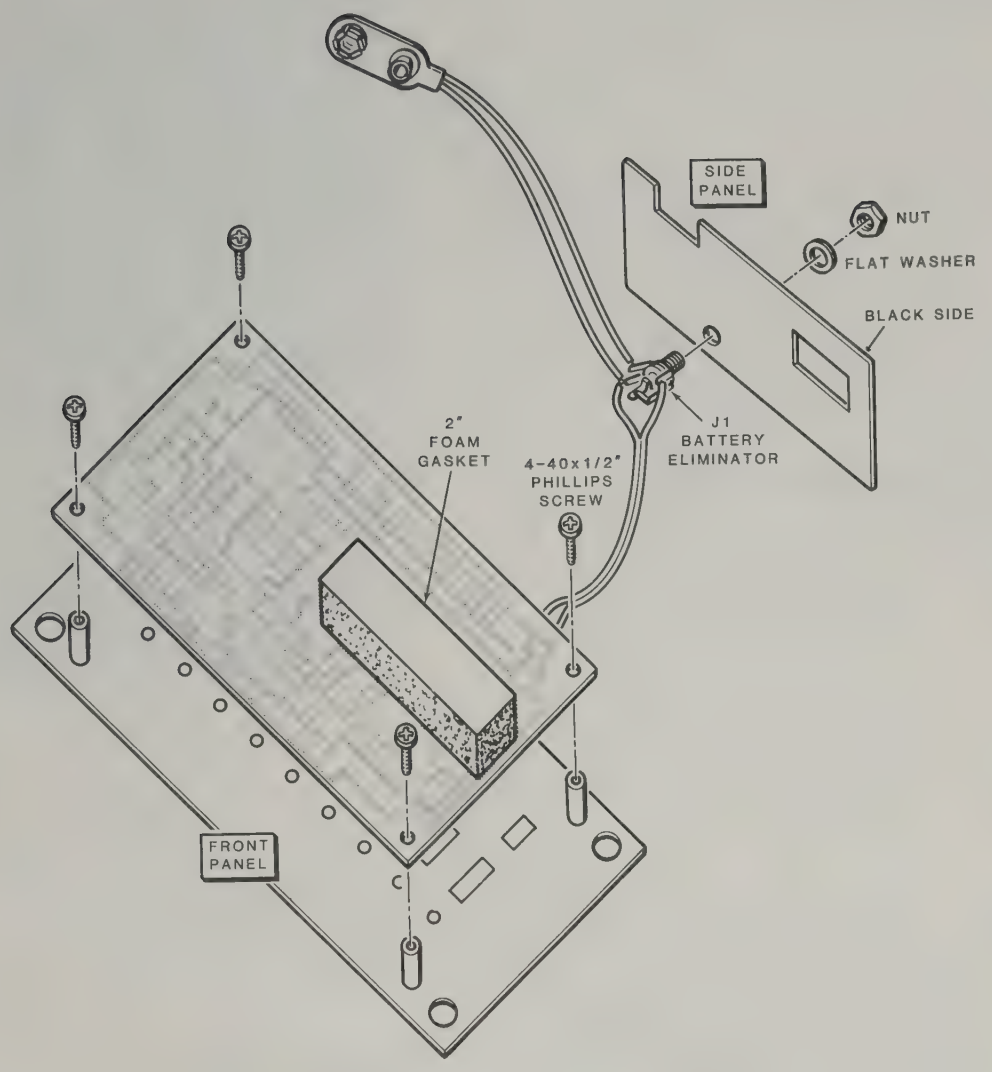
DETAIL 1-5D



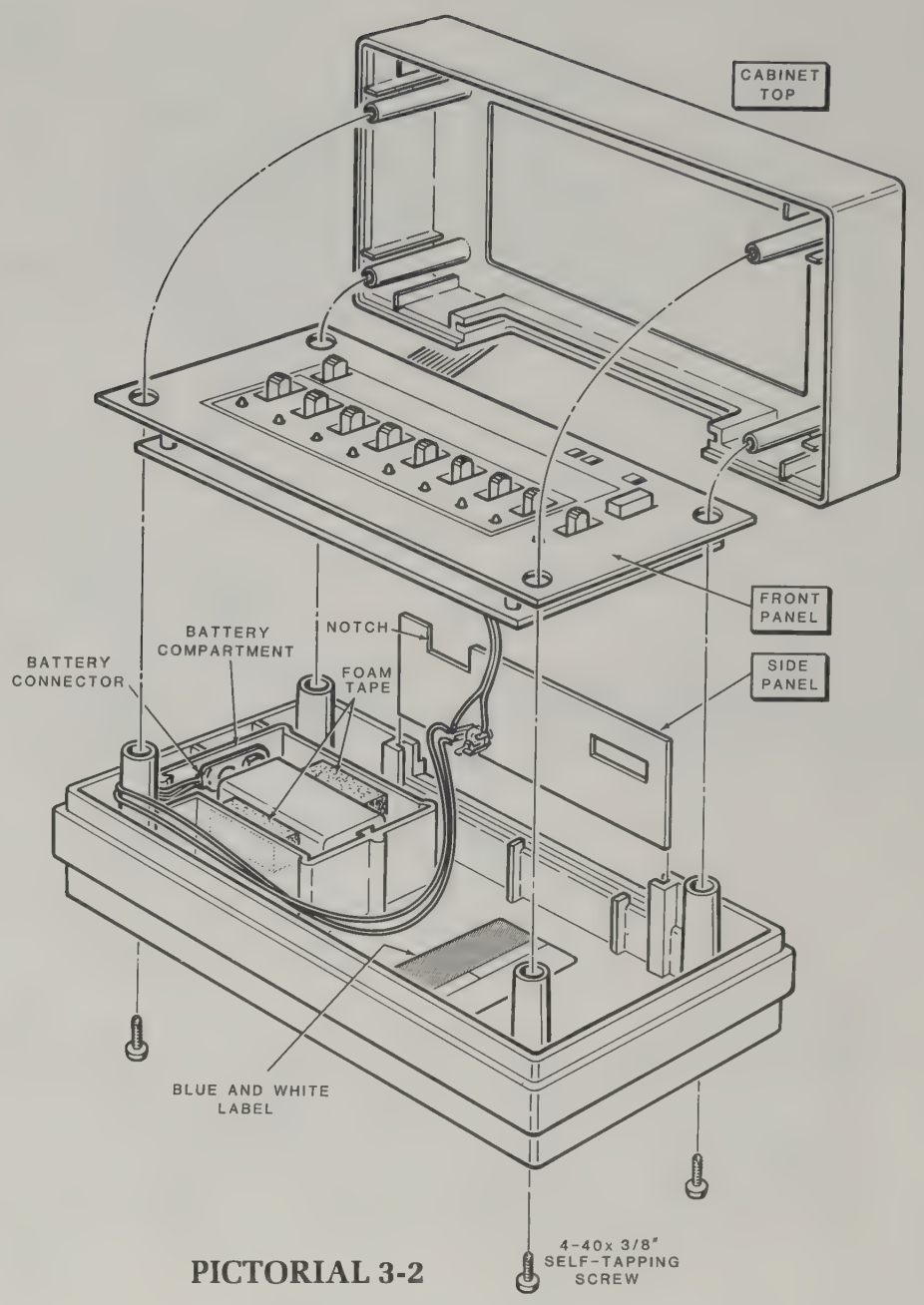
PICTORIAL 1-6



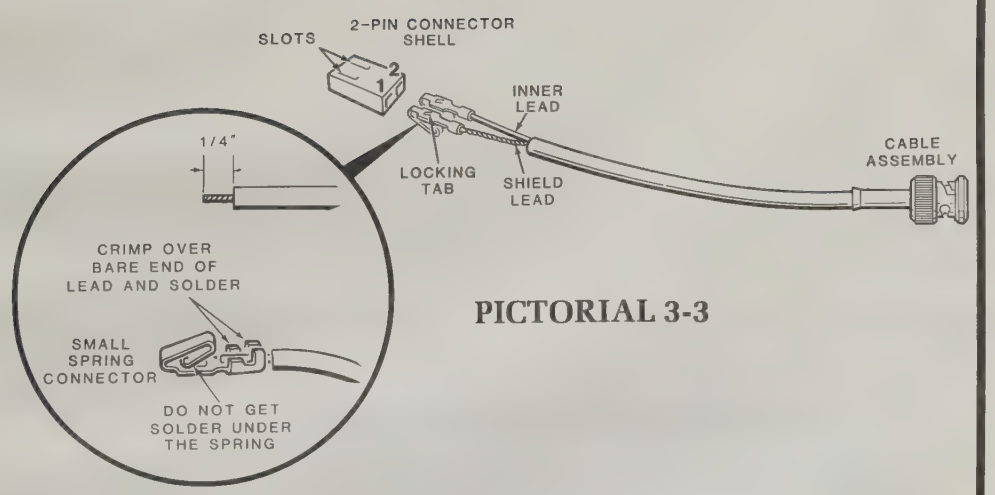
PICTORIAL 2-1



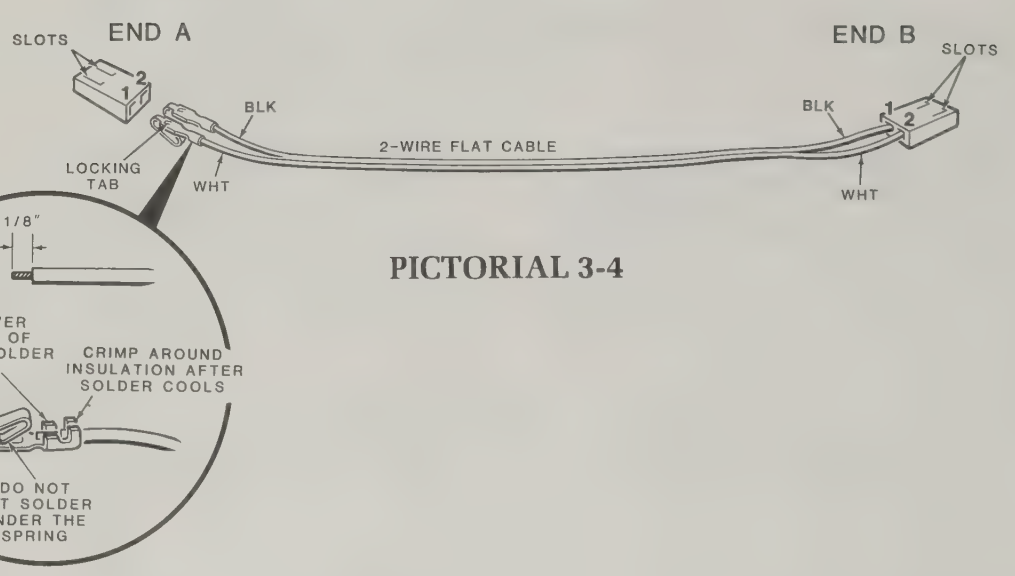
PICTORIAL 3-1



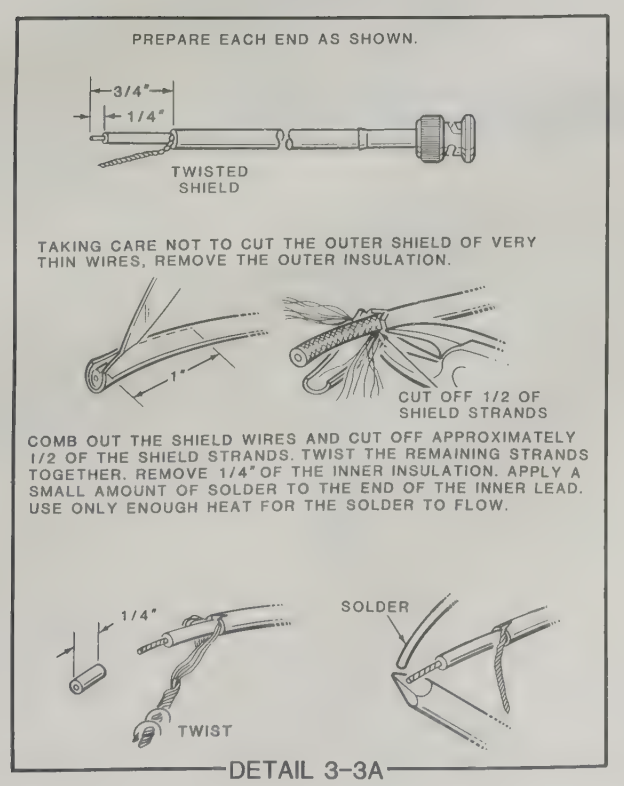
PICTORIAL 3-2



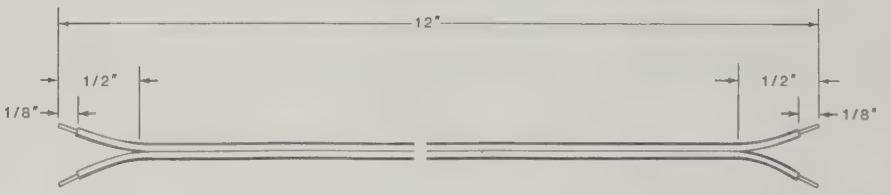
PICTORIAL 3-3



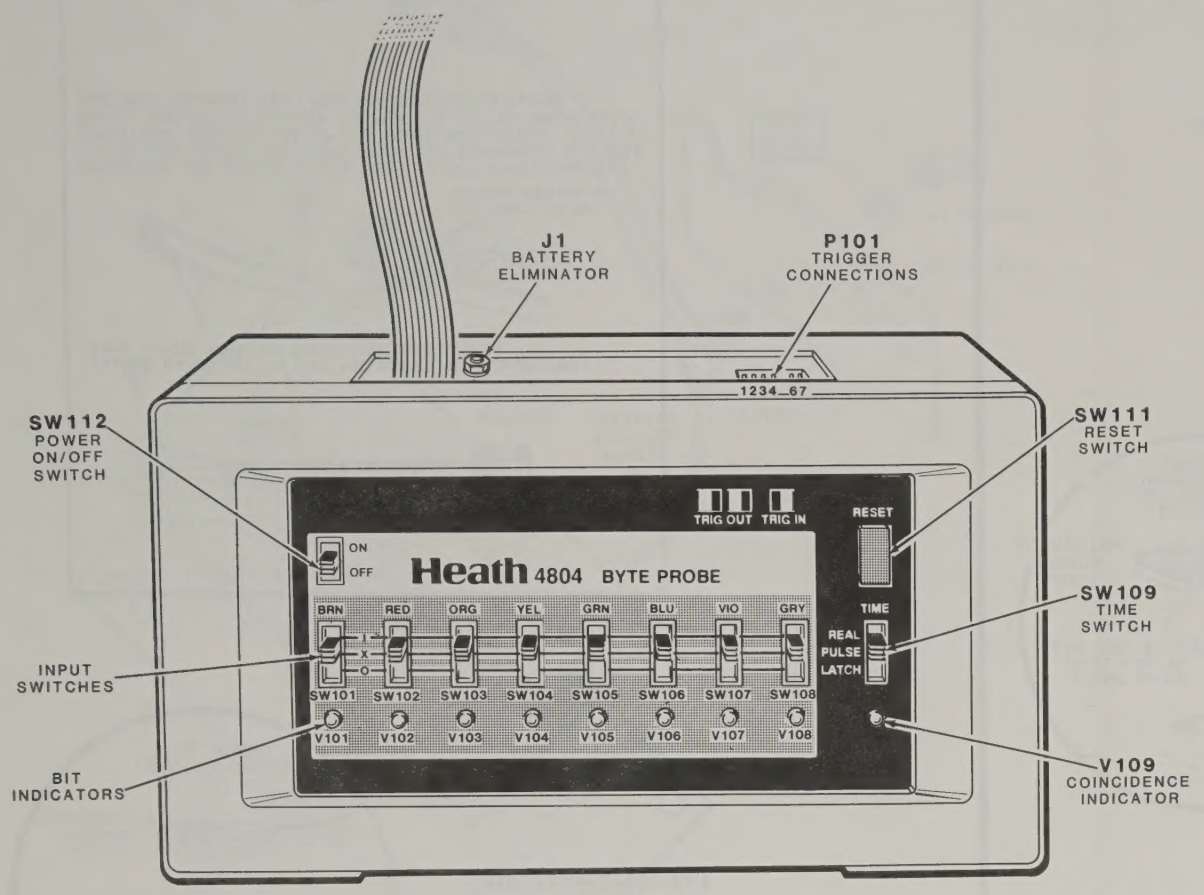
PICTORIAL 3-4



DETAIL 3-3A

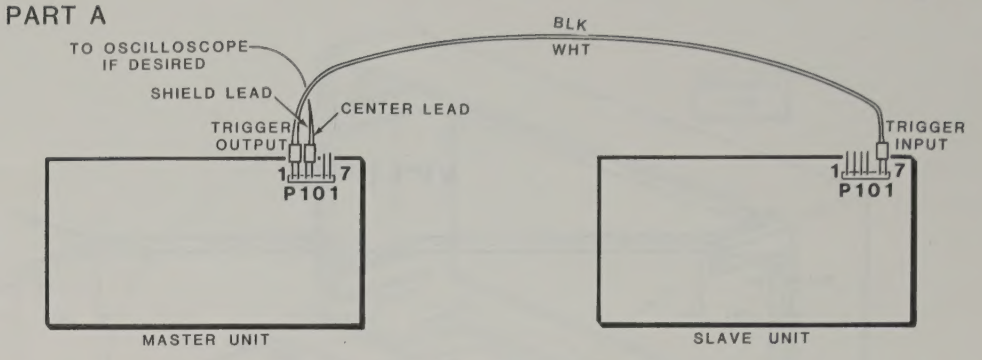


Detail 3-4A

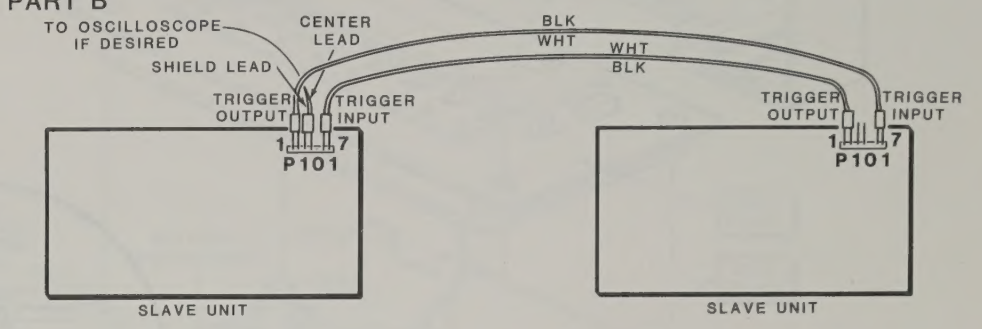


PICTORIAL 4-1

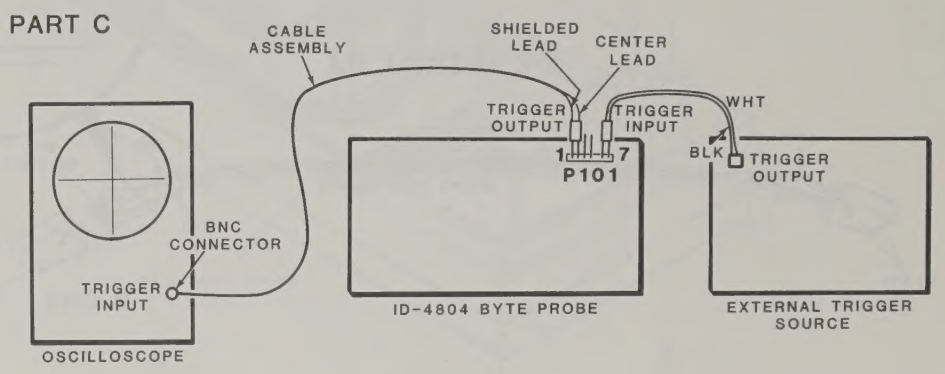
PART A



PART B

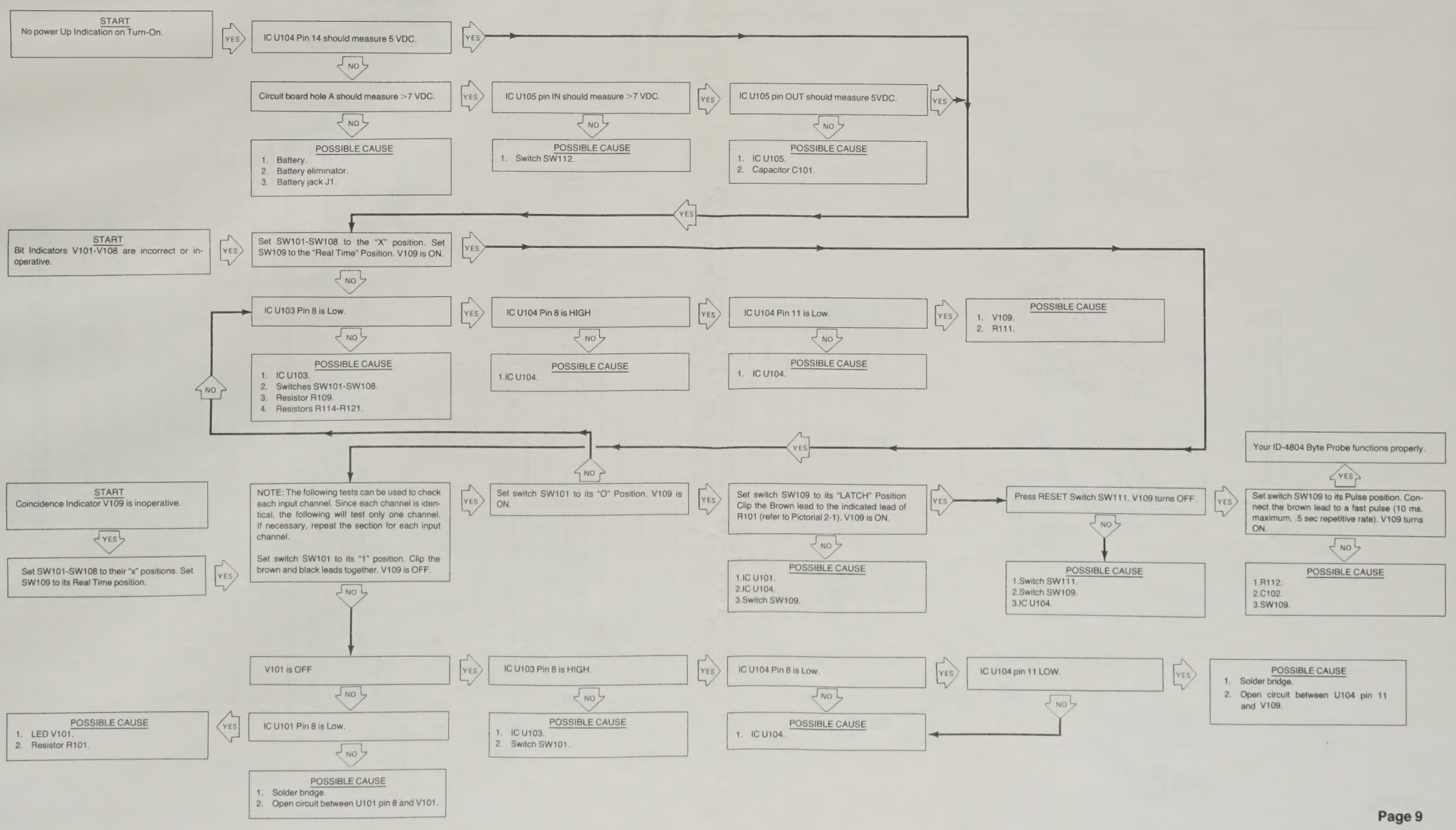


PART C



PICTORIAL 4-2

TROUBLESHOOTING FLOW CHART

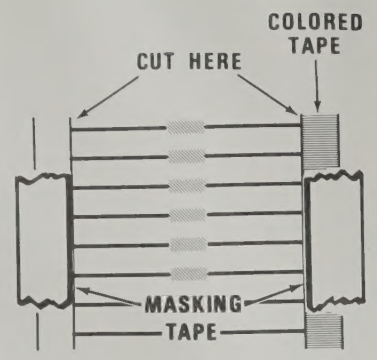


TAPED COMPONENTS CHART

Read and Follow These Instructions Before You Install the First Component.

Use masking tape to tape the component strips over the component drawings, as shown in the Taping Detail. Be sure each part on the strip is over its correct illustration; and that resistor color bands, and any part numbers, match their drawings. Cut the tape, as necessary, to align each section. Do not remove any parts from the strip until they are called for in the assembly instructions.

NOTE: Never attempt to pull the components free from the tape; gum residue from the the tape could cause an intermittent solder connection. Use diagonal cutters to remove each part as it is called for in the assembly instructions. Cut the leads at the inside edge of the tape as shown.



Taping Detail

SECTION 1

510 Ω (grn-brn-brn)
0.1 µF (104)
4700 µ (yel-viol-red)
510 µ (grn-brn-brn)
510 µ (grn-brn-brn)
4700 µ (yel-viol-red)
4700 µ (yel-viol-red)
510 µ (grn-brn-brn)
510 µ (grn-brn-brn)
4700 µ (yel-viol-red)
4700 µ (yel-viol-red)

SECTION 2

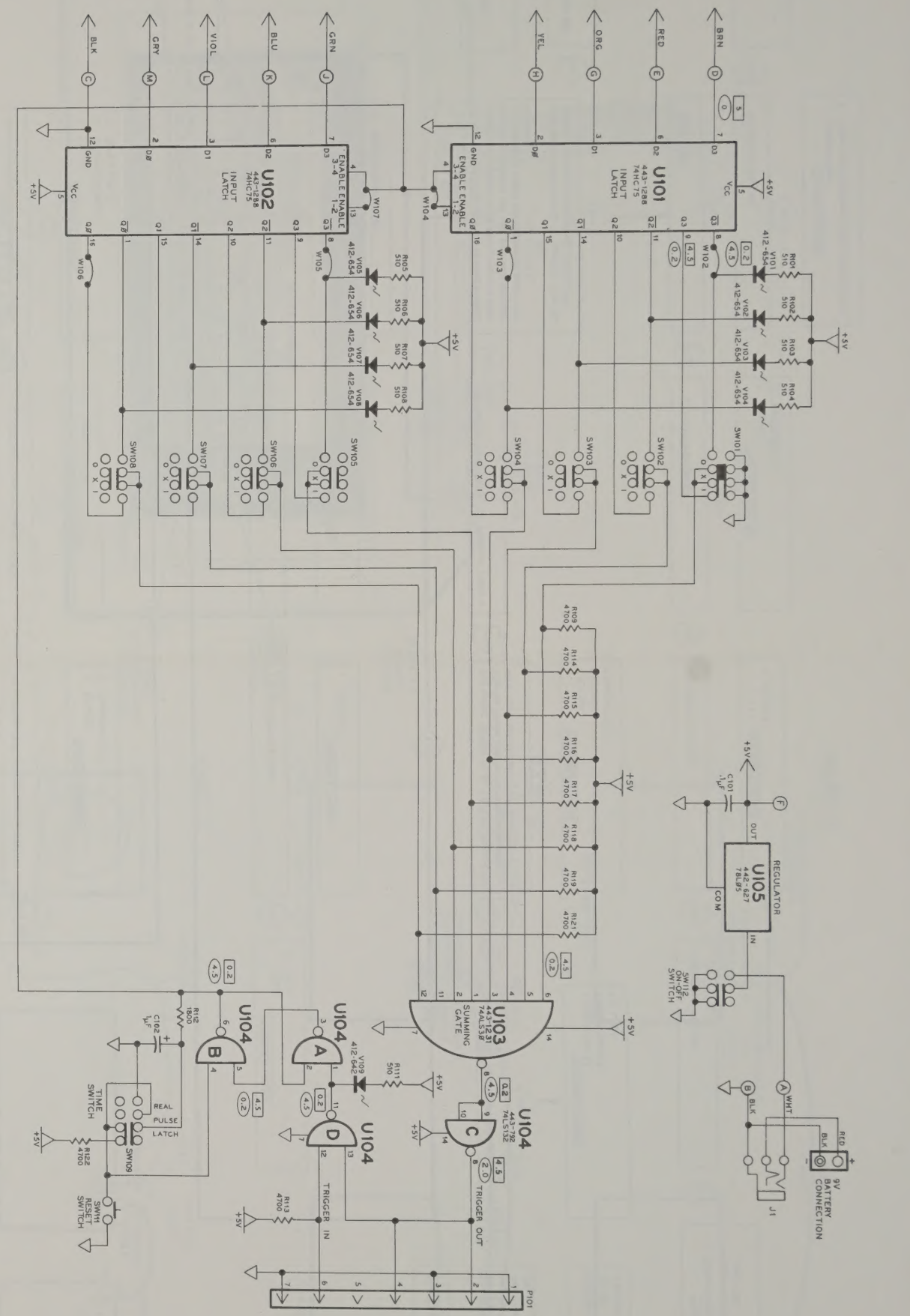
510 µ (grn-brn-brn)
510 µ (grn-brn-brn)
4700 µ (yel-viol-red)
4700 µ (yel-viol-red)
510 µ (grn-brn-brn)
1800 µ (brn-gray-red)
1 µF tantalum
510 µ (grn-brn-brn)
4700 µ (yel-viol-red)
4700 µ (yel-viol-red)

CUT HERE

SCHEMATIC OF THE HEATHKIT® ID-4804 Byte Probe

SCHEMATIC NOTES:

1. SW101 IS SET TO ITS "1" POSITION.
2. SW102 – SW108 ARE SET TO THEIR "X" POSITION.
3. SW109 IS SET TO ITS "LATCH" POSITION.
4. ▭ INDICATES THE PROPER VOLTAGE WHEN A LOGIC "1" IS APPLIED TO THE INPUT CONNECTOR.
5. ⬭ INDICATES THE PROPER VOLTAGE WHEN A LOGIC "0" IS APPLIED TO THE INPUT CONNECTOR.
6. ALL VOLTAGES ARE POSITIVE (+) DC.
7. ALL VOLTAGES ARE +/- 20%.
8. ALL RESISTORS ARE 1/4-WATT, 5%.



HTH BYTE PROBE ID-4204